

Communication problems between actors in construction projects

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Thesis submitted for examination for the degree of Master's Programme in Building Technology

Espoo, May 29th, 2017

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Title: Communication problems between actors in construction projects		
Date: 29.5.2017	Language: English	Number of pages:87
Department of Civil Engineering		
Professorship: Construction management		
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<p>Communication is a fundamental part of a construction project. Like any fundamental piece, it must be done in an effective way to ensure the success of the project. Given its importance, understanding the relationship between the different actors involved in a project, analysing the problems that arise between them and investigating the best options to ensure its correct functioning is very important for any actor involved in construction projects.</p> <p>This thesis, therefore, has as main objective to investigate the problems of communication between the actors involved in construction projects. The thesis will answer the following questions: How does communication within a construction project work? What are the main communication problems that arise in a construction project? How are these problems solved, with what practices and tools?</p> <p>To solve these questions, a research will be done divided into two parts. The first part is an analysis of the existing literature on communication in construction projects. The second part is an empirical study conducted a qualitative analysis of twelve interviews. These interviews will be made to actors with extensive experience in the sector who have recently been involved in various construction projects.</p> <p>The results of the thesis indicate the importance of communication within a project and the use of good tools and practices to promote their effectiveness. In addition, the study indicates that there are several widespread problems in construction projects. There is an extended problem with documentation management, this problem is tried to be solved with the use of Information and Communication Technologies. The next problem arises from the informality of many of the communications and from not recording solutions and agreements. A good use of the tools and practices available to the actors involved in the project must solve this problem. The last problem observed and probably the most serious is a widespread communication problem derived by the dispute that seems to exist in the sector, between the construction company and the project management. Avoiding cuts in the budget and trying to avoid many changes with its consequent decrease in the quality of the project, should avoid this problem.</p>		
Keywords: <i>Communication, Construction projects, Actors, Problems, Disputes</i>		

Acknowledgements

First, thanks to my supervisor in the School of Engineering of Aalto's University, Antti Peltokorpi. I would like to thank him for his help during all this period and for motivating me while I was writing the thesis.

Special thanks to my supervisor in my home university of Valencia, Pedro Calderón, for helping me in everything that has been possible and to my advisor Petteri Uusitalo.

In addition, I would like to thank all the people who have participated in the thesis. All the interviewees, thank you very much for showing interest in the subject and finding time to help me.

Finally, thank all those who have shown interest and have worried about me throughout all the months in which I have been performing this thesis.

Preface

This thesis is submitted to fulfil the requirements for the Master's Degree in Building Technology of the Aalto University School of Engineering, as well as the Master Universitario en Ingeniería de Caminos Canales y Puertos of the ETSICCP at the Universitat Politècnica de València.

The thesis is the result of six months of research work in the Department of Civil Engineering at the Aalto University.

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Abbreviations

AEC	Architectural, Engineering and Construction
ASP	Application Service Providers
BIM	Building Information Modelling
BPR	Business Process Reengineering
CAD	Computer Aid Design
CII	Construction Industry Institute
CM	Construction Manager
CMAR	Construction Management At-Risk
DB	Design-Build
DBB	Design-Bid-Build
EDM	Electronic Document Management
GC	General Contractor
HRM	Human Resources Management
ICT	Information and Communication Technology
nD	N Dimensions
PDA	Personal Digital Assistant
PSWS	Project Specific Web Sites
SEC	Special Engineering Contractors
UK	United Kingdom
VR	Virtual Reality

WPMS	Web-based Project Management Systems
3D	Three Dimensions
4D	Four Dimensions

1. INTRODUCTION

This chapter contains the main reasons of the selected topic. Firstly, the background of the study is reviewed. Secondly, the objectives, the variables and the research questions are presented, followed by the methodology. Finally, the structure of the thesis is defined.

1.1. Background of the study

Conflicts and disputes seem to be a never ending story within the construction industry (Love, Davis, London, & Jasper, 2008), and there are many terms used to define and describe these problems, such as delay in delivery, increased project cost, reduced productivity, loss of profit, or damaged professional or business relationship. "The complex, relational, and lengthy process of designing and building makes construction a process in which disputes are virtually ensured" (McManamy, 1994).

In all these disputes and problems that occur in the construction sector communication has a fundamental role. To ensure that in a construction project, all the actors involved in it, maintain throughout the development of the project an effective communication is fundamental to avoid problems and get the project to succeed.

For this reason, it will be studied through an analysis of the existing literature and an empirical analysis based on interviews with different actors involved in construction projects, the communication problems that arise between the actors involved and how these problems have been solved. Since: "It is considered that as much as 95% of disputes within construction are resolved directly between the parties involved "(Stipanowich, 2004).

1.2. Aim and objectives

This thesis is focused on analysing the communication among actors in construction projects.

To fulfil this goal, it is needed to focus on specific objectives. With the literature review, the goal is to understand the communication in the construction projects, identify which are the communication challenges in the construction projects and the possible solutions to manage those challenges. With the empirical study, particular construction projects will be analysed. The goal is to analyse the communication tools and practices used and explore the

communication problems between the actors. Finally, analyse if those problems have been solved and how.

Settle this, to conclude this section it is necessary to write down the main questions and hypothesis that this thesis pretends to answer.

- How does communication within a construction project work?
- Which are the main communication challenges/problems in the construction project?
- What are the identified good communication methods/tools to tackle those problems?

1.3. Research methodology

There are different types of research. Descriptive or analytical, applied or fundamental, quantitative or qualitative and conceptual or empirical, (C.R. Kothari, 2004). Among all these types, this research is going to be analytical, applied, qualitative and empirical.

The research is going to be analytical because will be focused on facts and information already available and during the research, a critical evaluation of that material is going to be made. The applied research aims at finding a solution for a problem that in this case, the construction sector has, whereas fundamental research is mainly concerned with generalisations and with the formulation of a theory. According to the qualitative research, quantitative research is ruled out because is based on the measurement of quantity and therefore it is applicable to phenomena that can be expressed in terms of quantity. On the other hand, qualitative research is concerned with qualitative phenomena, when we are interested in investigating the reasons for human behaviour we quite often talk of “Motivation Research” an important type of qualitative research. This type of research aims at discovering the primary motives and desires, using interviews for the purpose. To conclude, this research is empirical because relies on experience and observation. It is a database research, coming up with conclusions, which are capable of being verified, by observation or experiment.

This way of doing the research has been chosen because it is perfectly adapted to the objective of the thesis. Studying the communication problems in construction projects implies that it is necessary to analyse concrete real projects. To study them through the testimony of actors involved in them, learning the communication tools used, understanding the problems that have arisen and why, as well as how they have been solved.

The research consists of two parts. The first part of the research focus on the analysis of the existing literature about communication problems in construction projects. The existing literature that is going to be analysed is obtained through the database Scopus. This analysis of existing literature on communication problems in construction projects will be used as a basis for writing the conclusions of the thesis. By means of a comparison between the results obtained in the empirical analysis and the information obtained from the literature research, it will be possible to evaluate if the communication problems in the construction projects coincide and if all the possible techniques and tools are applied to favour an effective communication. In summary, thanks to this literature research will be able to discuss and analyse better the different construction projects of the empirical research.

The second part of the research aims to understand better, how communication works between the actors involved in the construction projects from within. Introduces a human touch by conducting several interviews with different actors of the construction sector with several years of experience and different backgrounds to analyse their experience, their point of view and the problems that have had according to communication in the development of the project to find a common pattern and a solution.

1.4. Thesis limitations

After a couple of changes in the research topic, the thesis is going to focus on communication problems in construction projects. For a few months, the criterion of the search of articles for the investigation of the existing literature was not very clear but in the end, this problem was solved.

The author finds that the vast majority of articles on this subject are written at the beginning of the 21st century so he finds articles somehow outdated in terms of new technologies, hence the lack of modern articles on this subject is a limitation. As the reader will see throughout

the thesis, this outdatedness is not only found in the articles but rather extends to the entire construction sector.

Finally, as explained in the corresponding chapter of the thesis, finding people willing to participate in the interviews has also been a limitation.

1.5. Thesis outline

The thesis has four chapters that are described below:

The first chapter presents the introduction of the thesis, where the background, the aim and objectives, the research methodology and the limitations are described.

The second chapter describes all the literature review. The chapter is divided into five sections trying to cover the most important topics of the communication issues in the construction sector and ending with a summary of that review.

The third chapter discusses the empirical study. The first section of the chapter explains how is going to carry out the research and the second section presents the principal results and findings.

The final chapter, chapter 4, contains the discussion and conclusions of the study.

2. LITERATURE REVIEW

This chapter is focused on the theoretical background of this research. The chapter is divided into five sections.

The first one is an introduction of communication, several definitions are presented and the importance of it in the construction sector is explained.

The next section describes the communication within construction projects focusing on the networks that are created, the communication structures and the individual behaviour of those involved in the projects.

The third section focus on the challenges of communicating in construction projects, the nature of the project itself, inter and intra organisational barriers, the structural constraints and the specific challenges of the project manager.

The fourth section discusses several ways of managing communication within construction projects and how to tackle those challenges described in the third section.

Finally, a summary made by the author about the literature review is presented in the final section of the chapter.

2.1. Introduction to communication in construction industry

This introduction aims to define communication and its importance in the construction industry. Highlighting the importance of effective communication in all the communication processes in the development of construction projects.

2.1.1. Defining communication

In construction, information is specially varied given the huge number of actors involved in all the construction operations. Communication usually involves the transfer of information, a generic term that embraces meanings such as knowledge, processed data, skills and technology (Cheng *et al.*, 2001).

The different locations of those involved in construction projects also encourage communication. To communicate is to *bridge a distance* of some description, which can

range from being short and simple (e.g. between two people) to long and complex (e.g. across the world) (Skyttner, 1998).

Construction is a team activity involving many different actors specialized in many different topics in order to fulfil the project goals. Communications do not only occur between individuals, but can occur between groups or organizations (Baguley, 1994).

After these definitions of communication, can be said that communication is basically the exchange of information between people. This interaction will be determined by the rules and norms of social behaviour, as it is people who translate the meanings and utilise the information (Gayeski, 1993).

This statement proposes that communication is a two-way process. Communication involves the giving out of messages from one person and the receiving (and successful understanding) of messages by another in response (Torrington and Hall, 1998: 112). In other words, in order to success in communication, the source of the information has to receive feedback about it. The receiver of the information has to give feedback that the message has been received, understood and will resolve the issue if not immediately as quickly as possible. The ways of communicating information can be multiple. The speech, body language, writing, electronic data or a combination of these forms. In addition, communication can be viewed as a professional practice where appropriate rules and tools can be applied in order enhance the utility of the information communicated, as much as it can a social process of interaction between people (Dainty *et al.*, 2006).

2.1.2. The importance of effective communication.

Individuals, project teams or entire organizations cannot underestimate the importance of effective communication. There is plenty of articles about management containing important values of how to communicate effectively with your co-workers. Either individually or like a team, in the industry it is tough to function properly if people do not develop an agreed communication to reinforce the work.

In the same way, management of projects also demands effective communication networks, in order to enable all the actors involved in it. Armstrong (2001: 807) concisely summarizes the importance of communication in team projects:

- *Achieving coordinated results* – construction projects function by means of the collective actions of actors, but independent actions lead to outcomes incongruent with the project objectives. Coordinated outcomes, therefore demand effective communications.
- *Managing change* – most construction projects are subject to continuous change. This, in turn, affects their teams. Acceptance and disposition to embrace change is possible only if the reasons for this change are well communicated.
- *Motivating workforces* – the degree to which an individual is motivated to work effectively in the construction project is dependent upon the responsibility they have and the scope for achievement afforded by their role. Feelings in this regard will depend upon the quality of communications from senior managers within their projects.
- *Understanding the needs of the workforce* – within team projects, to be able to respond effectively to the needs of their employees, it is vital that they develop an efficient channel of communication. This two-way channel must allow the feedback from the workforce on organizational policy in a way that encourages an open and honest dialogue between employees at all levels, even at the top-level managers of the team.

Noting all the benefits, mentioned above, that has good communication within a team that manages a project. It can be interpreted that a bad communication can lead to not understanding correctly the management decisions and to realise in an unintentional way actions that can damage to the correct realisation of the project. In the same way, managers may misunderstand the needs of their employees. These misinterpretations imply that the team does not perform at full capacity and that they generate uncomfortable situations blaming each other for not communicating effectively.

Communication over the years has become, increasingly, a key piece in the business world. It could be said that most construction companies are becoming a sector service organisation, outsourcing the great part of their productive capacity and at the same time acting as managers of the whole process. Therefore, another fundamental requirement for effective communication in the construction world is to understand the changing industry and the

transition it is undergoing. These changes are often more problematic in industries as traditional as construction, which is always upset by changes in the way of working. Overcoming this fear of change is key. Begin using all the new technologies and knowledge that gradually arise and which today are increasingly present the sector should be a measure that companies that want progress should take and apply to their construction projects. In the past, a 'silo' like mentality has prevailed which has been shown to block knowledge sharing within the industry (Dainty et al., 2004). However, effective communication has the power to break down existing barriers in the sector. Strengthening relationships and collaboration among employees, proposing an improvement in working conditions thanks to new communication technologies. Therefore, an effective communication can be understood as the key element of the evolution and improvement of the construction industry.

2.1.3. Human aspects of communication in construction

The environment generated in construction projects favours the creation of conflicts due to the enormous diversity of agents involved and their different specialities, circumstances, and ways of understanding situations (A. Dainty *et al.* 2006). For this reason, effective communication is especially important for this type of projects.

All the people who are involved in construction have an important role in the complex communication system. Understanding the project environment as an interconnected network of actors is the most appropriate, because no matter the challenge that arises, however small, it will not be successfully resolved without interaction and information transactions between all the people or organisations involved. The owner, the designers, the contractor and all his equipment, the suppliers, all have to favour good communication and keep informed at all times of what they do each other (David Moore *et al.* 2006).

Construction is not peculiar in its reliance upon effective communication. Indeed, without the ability to communicate, it is possible that any contemporary organisation would cease to exist, as we understand them (Katz and Kahn, 1978). As the construction, industry is based mostly on projects, a series of groups and temporary networks are generated by relationships and interactions that constantly change, reflecting perfectly explained above, the dynamism of the work environment. The projects themselves are unique and can be defined by their complexity and discontinuity. Each project has unique characteristics that are rarely repeated. Also, in each project are involved a series of actors that together form a unique

environment with a specific meaning. Overcoming the complex and temporal constraints that projects place on their participants is fundamental to their successful development (Goczol and Scoubeau, 2003). Therefore, while the construction industry is an established sector in which a series of protocols have been defined to facilitate communication in it, there is always some element that can fail and that has the risk of overturning the necessary communication channels that the project needs to be successful.

In spite of the great investment that has been made in the last years in information and communications technologies (ICT), it is impossible to separate the personal relationships that are generated within the work group during the construction process. It is in the personal interactions that the success or failure of any project is forged and not in the compatibility of computers with a type of software such as Computer Aid Design (CAD). Understanding this idea is essential for managers and for understanding construction as a social activity where communication has a vital role (A.P. Chassiakos, 2007).

Given the centrality of effective human communication to the success of the industry, it is surprising that so many of the recent calls for the industry to improve its performance concentrate on process and product improvements at the expense of the need to improve the complex inter-organisational and interpersonal relationships, that define the industry's culture (see Emmitt and Gorse, 2003: 2). It is true, that all people involved in a construction project can't be expected to behave exactly in the same way. Members who make up a project team have different backgrounds and different perspectives of the situation, making impossible for them to interact in the same way with each other.

2.2. Communication within construction projects

Managers from different industries and sectors carry out various tasks and activities, but it is well known that with one of the tasks that are involved the most is communication (Baguley, 1994: 3; Huczynski and Buchanan, 2001: 178). Communication is a fundamental social activity that includes conversations, listening to co-workers, networking, gathering information, directing subordinates and transferring information through electronic devices such as smartphones or computers. All these activities are carried out in the construction projects and to achieve success in the project it is necessary to achieve success in communication.

2.2.1. Communication networks

The communication network that emerges in the groups determines their communication patterns. Many factors affect how members of the group communicate and how managers design it. However, no matter how the group is configured, the actors that compose it will determine the way in which the information flows. Understanding the communication networks that are generated is vital to understanding how project teams work (Malisiovas and Song, 2014).

Formal communication networks are those that are defined by the structure of the organisation, rules or procedures used and relationships between staff, teams or departments (Dainty *et al.* 2006). Although these are important, the most powerful and important groups in organisations are not appointed at all, but emerge from the communication that people undertake as part of their organisational life (Eisenberg and Goodhall, 1993: 273). These emerging networks coexist and interact with formal ones. It could be said that communication has more influence on the structure than vice versa. An example could be the relationship between departments of a company, which formally should not have any relationship, but which, need to communicate with each other to manage the workload. Applying this example to the world of construction, consider two different construction projects managed by different divisions but located one near the other. Although they do not share managers, they may want to keep open communication with each other, for example, sharing resources or renting machinery on a larger scale. This informal and temporal communication can benefit the projects and is totally outside the formal communication lines defined by the organisation that manages each project.

In construction companies, networks vary in size and density. The number of connections with other groups can be understood with density. Dense groupings (or 'clusters') of individuals have a profound impact on innovation within organisations and whether others will adopt new processes or technologies (see Albrecht and Hall, 1991). This is one reason why communities of practice are known to be organizationally beneficial to the generation and adoption of new ideas (see Wenger *et al.*, 2002). Managers should encourage groups of individuals to come together and meet to benefit each other from the benefits of having a larger group. Managers should identify the most beneficial informal communication networks and promote its growth and development to benefit the project.

2.2.2. Communication structures

In the construction industry, because of the amount of information that is handled in the projects and the number of participants involved, the communication channels have to be well defined and are a vital part of the proper functioning of the industry. These channels include protocols, or roles and responsibilities, in relation to the importance of the information and how it should be transmitted. Defining the communication structures with their corresponding protocols favours the efficient use of information and helps to understand how it is transmitted (Otter and Emmitt, 2007).

In the project team, many companies define the formal way of managing the information among the members that compose it. This can include, for example, where different documents are placed and how they are distributed, such as plans, or work items. Although it is crucial to ensure that information is managed efficiently, the overall view of the structure is greatly limited if it is viewed as only a series of channels through which information can be transferred (Aasrum, J. 2016). This simplification does not help, since it defines the receiver of the information as a passive person that does not interact in the transmission of information.

Kerzner (1997) describes how business flowcharts can be used to describe how communication, both internal and external, should be carried out and recommends that project managers use a communication accountability matrix. Kerzner says that organisational charts are important for managing the project, but he understands that they do not describe the interaction of the people involved perfectly and that the reality is more complex.

Some writers like Kelley (2013) conceptualise the communication network within different delivery methods. The DBB (Design-Bid-Build) delivery method involving the three main actors: the owner, the design team and the general contractor. The owner contracts an architect or an engineer to design the project and enters into a separate contract with a general contractor for construction as is shown in Figure 1.

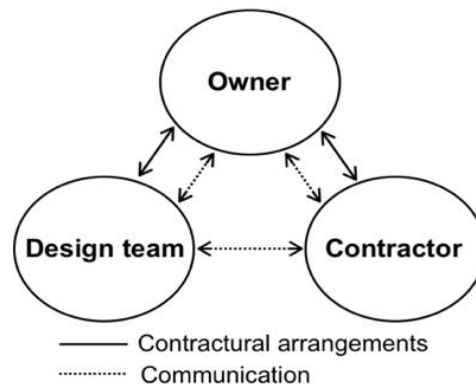


Figure 1. Project organisation structure for DBB

Source: Adapted from Kelley 2013

In the DB (Design-Build) approach, the owner contracts with a single entity that is responsible for both the design and the construction phase (Kelley 2013). The DB approach differs from the traditional approach in the single line of responsibility between the owner and the design builder. Figure 2 shows that from an owner's standpoint, the DB approach significantly simplifies the chain of responsibility in the project.

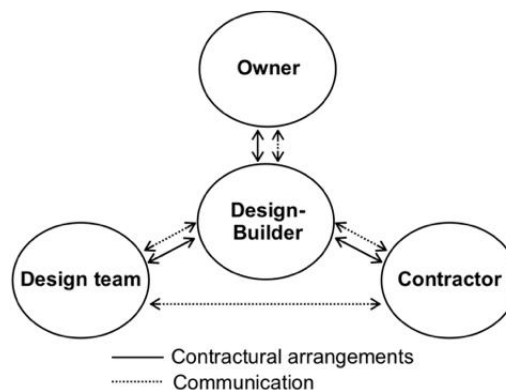


Figure 2. Project organisation structure for DB

Source: Adapted from Kelley 2013

In contrast to the DBB approach, the use of the DB method allows the design, procurement and construction phases to overlap, which results in much shorter project times (Kelley 2013).

The increased complexity of AEC (Architecture, Engineering and Construction) projects has led to the development of CMAR (Construction Management At-Risk) delivery method. Using the CMAR delivery method, the owner contracts with a Construction Manager (CM)

that commits to deliver the project within a guaranteed maximum price. The CM supports the owner in the design stage, by acting as a consultant and providing expertise in scheduling, estimating and cost-control (Kelley 2013). In the construction phase, however, the CM is seen as equivalent to a GC (General Contractor). The CM firm does accordingly not necessarily perform any design or construction activities of their own, but rather act as the owner's representative, controlling and managing the flow of information during the life cycle of the project as illustrated in Figure 3.

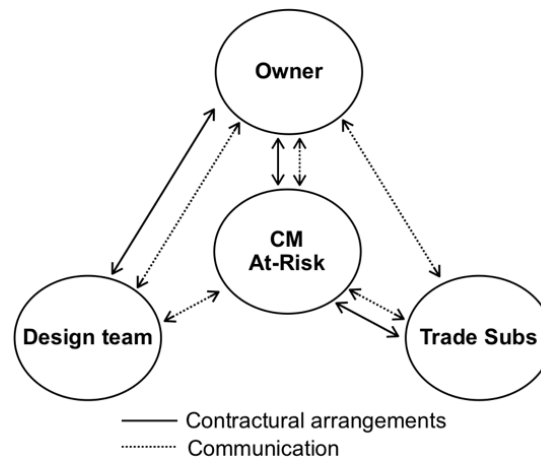


Figure 3. Project organisation structure for CMAR

Source: Adapted from Kelley 2013

In this way, Kelley (2013) explains in a visual way the different structures that are generated in the three main delivery methods.

2.2.3. Individual behaviour related to communication

In construction projects, many individuals come together. Understanding their behaviour, motivations and way of thinking is essential to achieve effective communication between project members and achieve the project success.

The key to successful communication is to ensure that what you want to communicate is useful. This means that there must be communications that inform about all the problems and that integrate the efforts of those involved to ensure their commitment. The way in which an individual interprets the information he receives is entirely personal and depends on the content. No matter how well are structured the company or the project, that the individual, by its culture, can ignore or misinterpret the information that receives. This perspective

recognises that discourse within organisations is essentially a social activity where members use and interpret language to structure their own realities (Francis, 2002).

There are individuals who may not effectively communicate with others by factors inherent in their person, such as their personality or prejudices that may come from the environment in which they were formed. These factors cannot be solved with a good communication structure. In addition, the role of these individuals in communication may be different from their formal role in the project. This is because, for most people, their individual communication networks are something that they value and hence, nurture, develop and maintain their own advantage (Dainty *et al.*, 2006). Individuals who come from a particular profession, with a very marked environment, have their own language and defined behaviour that can affect their way of communicating within the organisation of the project. In addition, the impact of these behaviours and attitudes does not have to be defined only in individuals with more experience, who has been working for many years in the sector; more novice employees may also have very marked attitudes towards communication. Correct these attitudes and get all the actors involved in the construction project want to maintain a positive attitude towards communication is essential for the correct development of the project.

2.3. Challenges of communicating in construction projects

This section will present the main communication challenges that arise in construction projects. To understand these communication challenges must be explained first the background of construction projects.

Along with shipbuilding and aerospace, the construction industry is one of the oldest and most established project-based sectors (Keegan and Turner, 2003). Although in the last century the industry has evolved from being mainly craft based to a more versatile version, the project has remained undisturbed and a fundamental unit of the industry. While the construction has adopted innovations, its evolution continues being linked to the limitations that it has to produce in a fixed place. Because despite the evolution, it is still being built in situ and as it is based on projects, it joins a professional diversity in different locations. These people will work collectively for short periods of time, before they disband to work on other ventures (see Bryman *et al.*, 1987).

The project is temporary and all the participants have a series of objectives besides the general objective of the project success. The competition that generates different goals leads to discord and tension, which can end up in conflict within the construction project team. This situation leads to obstruction of communication and ultimately to failure of project objectives. Therefore, it is necessary to maintain effective communication and strive to work as a team to ultimately deliver the project in a satisfactory manner.

Before studying the techniques that favour effective communication, it is important to understand the difficulty in which the manager performs. The barriers that impede effective communication are very complex and varied due to the variation of the actors involved. Therefore, we will next study the nature of construction projects and the restrictions that their structure generates in communication. It will be emphasized how the nature of the sector is directed to temporal associations and by so many interactions of short duration and how this lack of continuity in the relations undermines the effective communication.

2.3.1. The nature of the project

For many years, poor communication practices have been recognised as a serious delimiting factor within the construction industry. Within the United Kingdom, a succession of government-commissioned reports has berated the industry for its apparent inability to communicate effectively, both internally and externally (Emmerson, 1962; Banwell, 1964; Latham, 1994; Egan, 1998; Strategic Forum, 2002). In the 21st century, a very large number of articles related to communication have been written, emphasising effective communication mechanisms. However, it seems that despite the existence of so many articles on the subject, and the concern that is latent, the construction industry does not just carry them out definitively. Despite the prevalence of reports and rhetorical commentary surrounding the need for improving communication performance, there has actually been little (if any) noticeable enhancement in communication performance in recent years (Emmitt and Gorse, 2003: 16). This situation leads one to wonder why the modern construction industry seems unable to apply these communication techniques and what the barriers that prevent such communication are.

The activities of the construction projects are very diverse, ranging from the simplest interior reform of a house to the most complex infrastructure works. However, all projects have a number of common features summarised by (Loosemore, *et al.* 2003) as:

- Their unique, one-off nature
- Their tendency to be awarded at short notice
- The labour intensiveness of construction activity
- Jargon, semantics and the potential for misunderstandings
- The reliance on a mobile workforce
- An ingrained male-dominated culture
- An increasingly diverse labour market

These unique features require a special company approach. The organisational priorities and the employees' expectations must be taken into account. Not being able to combine these approaches because of poor communication leads to problems in construction projects, especially in those more elaborate and more complex. The greatest danger lies in jeopardising the safety and health of workers. A sad example of poor communication was the disaster in Kansas City in 1981 at the Hyatt Regency Hotel where 114 people were killed and 200 injured when a crowded hall collapsed on a crowded dance floor. The chaotic communication between designers, architects and contractors led to a design error in the structural system and manifested itself in an inadequate inspection system. This disaster caused by the number of interactions between the parties involved in a construction project shows the most feared situation that can happen by not using effective communication.

2.3.2. Barriers in intra-organisational communication within construction projects

The barriers to effective communication in construction begin within the company itself. Construction companies, as previously described, contain very diverse employees. Directors, specialists, administrative, qualified and non-qualified. All these individuals have the need to communicate with each other, through the divisions of the company, departments and hierarchical situation to carry out their duties correctly. Project teams usually comprise of a mix of people drawn from different functional divisions and departments who each lend particular expertise to the production effort (Langford *et al.*, 1995). In this organisation network, a group of project managers temporarily leads employees but they permanently have to respond to their heads of the company. Within the team work there must be a mutual trust in the abilities of each member, this presents another communication challenge for the company.

An example of how communication can be affected by these company interfaces is found in Moore & Dainty's (1999, 2000, 2001) research exploring the nature of communication between members of a typical design-build group project. In this research they found that the advantages of design and build procurement can be harmed by the problems that arise from the different cultures of the actors involved in the project, sometimes too rigid. These cultural barriers inhibit the integration of the design and construction process. The research also explains factors that indicate that the difference in employee cultures is detrimental to the group's ability to handle changes, innovations, and improvements in the design and construction process.

Table 1. Jargon differences between architect and engineers

Source: Dadjji 1988

Term	To an architect	To an engineer
Air-conditioning	Any cooling system – probably comfort cooling	One particular system that is cooled, heated, humidity-controlled and ducted. Not comfort cooling
Contractor	Builder	Plumber or electrician
Duct	Anything needed for hidden services	A galvanised steel air-distribution system to HVAC publication DW142
Low-energy structure	Wood-framed, lightweight structure with turfed roof	Concrete structure with exterior insulation and heat exchanger
Natural ventilation	Windows	The passive passage of air-through grilles, chimneys, stacks and exposed mass
Pipe size	The actual size of the pipe with everything else included, such as insulation	The mean diameter of the pipe itself – excluding insulation thickness

Table 1 shows a simple example of how there may be problems and misunderstandings among professionals coming from different backgrounds within the construction industry, the same concept can be interpreted in two different ways depending on whether it is an architect or an engineer, generating communication problems.

Gorse and Emmitt (2003) explored interpersonal communication during construction progress meetings. In the research, they found that the management and interaction of the design team are subject to task-based interaction rules, but that these could be affected by the emotional interaction of those involved, which greatly influences the behaviour of the

group. They emphasise the individualised nature of communication within the construction sector and the propensity of individuals within the industry to act in ways that do not necessarily support interaction requirements. The number of unexpected events that occur within construction projects increases this problem. Loosemore (1996, 2000) conducted extensive research on behavioural patterns that occurred during crises within the industry. His research explains that communication patterns that arise in response to unforeseen events that occur during construction projects are very complex and many of which are unnecessary or counterproductive in terms of solving the problem in question. The conclusions of this research support the idea that communication within the construction company is exceptionally complex and problematic. It requires communication approaches that are very different from those that the sector is accustomed to ensure that the employees fulfil their objectives.

2.3.3. Barriers in inter-organisational communication within construction projects

Construction projects typically consist of many organisations working in an interdisciplinary environment with the aim of meeting a common goal in a given time period, which is an added difficulty. Considering that in any project of construction can be expected transitions and changes from the original idea, as much in subjects of design as later in the structure, the effective communication is once again an important aspect of all the operations of the industry. On the other hand, already seen the problems that communication companies have, moving information along its structure can become very problematic. The complex nature of the construction industry contributes to its extreme fragmentation compared to other sectors. Large projects nowadays involve a large number of stakeholders, each of which is only involved in a temporary part of the project's lifetime. Each individual has their own responsibilities to their company, in addition to the common responsibilities of the project. Promoting rapid communication between the parties involved in the project has a positive effect on the general communication problem.

The construction industry has a reputation for generating mistrust and blaming others when things start to go wrong. The parties involved in the project tend to express different opinions about what happened when there is a problem or to adjudicate the success of the project. These 'competing narratives' have been found to be more prone to exist in projects that

involve uncertainty; integration and urgency (Turner and Muller, 2003). This problem is quite common among construction projects and can act as a catalyst for major problems among project participants. Boddy and Paton (2004) examined this problem and commented that the differences between the parties involved are originated from the subjectivity of interpretation in certain matters and due to the project itself and the cultural, political or interest difference between the participants. Projects that are not well managed and fail to resolve this competitiveness between the parties, eventually fail because mistrust and scepticism created among the members of the project team. Therefore, one of the most important tasks of a project manager is to understand the source of competitiveness between the parties and to ensure that this competitiveness favours the project instead of destroying it.

To conclude this section, considering that the supply chain in the construction is very fragmented there are many more possibilities of problems between transmitters and receivers of information. Likewise, the more organizations involved in the project, the greater the risk for communication problems to be generated and conflicts and confusion in the day-to-day of the project. In fact, (Loosemore, et al., 2000) suggest that those choosing a construction career may do so because they thrive in adversarial and pressurised workplace environments. This has a direct effect on the communicative environment that surrounds the construction sector.

2.3.4. Structural constraints for effective communication within construction

The construction industry has a number of structural attributes that have been shown to impair communication. It is remarkable the aspect that the construction is generated by sequential activities. This sequential aspect may prevent effective communication between the parts that make up the supply chain. Love and Li (2000) who conducted a thorough investigation of two construction projects to explore the causes and costs of redoing jobs, provide a good example. They concluded that redoing jobs is attributable to the sequential nature of construction, resulting from poor communication and wrong decision-making processes. They also concluded by stating that the lack of structural flexibility and construction procedures can become a very negative factor in the resolution of projects.

Another interesting point to discuss is the role of this structure in facilitating or preventing communication. The structure can be developed formally in some aspects and in others in an informal way. The channels of formal organisation can be considered the most important because they are the ones that divide the tasks and give meaning to the organisational structure. However, informal communication is also important when implementing projects. Hooper in 1990 suggested that construction managers should allow teams to move between formal and informal structures in order to achieve their mandate. Figure 4 shows the informal communication channels within the formal hierarchy.

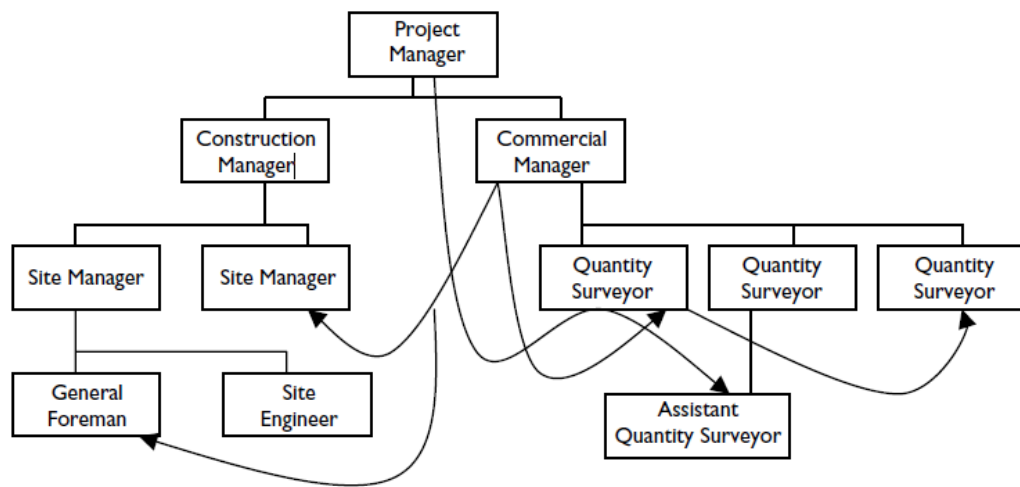


Figure 4. Formal and informal communication.

Source: Adapted from Dingle 1997

Dingle (1997) demonstrates how organisational channels do not faithfully represent the interactions between the actors involved in the project and who has the greatest responsibility within the organisation. There is communication between parts of the structure that can circumvent others, bypassing the formal communication protocol. These informal procedures seem more realistic when studying the decisions and confirm the greater flexibility existing in the communication that generates inevitable uncertainties in the construction process, but which, in turn, favour the correct execution of construction projects without delay.

The extent to which formal communication channels are generated in construction projects is defined by a combination of adjudications and contracts. These formal channels are predefined before the project begins and are imposed among the actors involved. This creates

a problem with the preconceived idea of communication that some actors have and that can collide with the established communication channels.

The tools used to make the communication also identify these channels of communication, formal and informal. Aasrum J. (2016) identifies the different tools used to communicate formally and informally in Table 2. The empirical analysis of the various construction projects will explain more in depth which of these tools are the most used and among which actors.

Table 2. Formal and informal communication tools

Source: Aasrum J. 2016

Formal	Grey zone	Informal
Formal meetings	Tablets	Informal meetings
Drawings	E-mails	Telephone
BIM		Video conferencing
Project intranets		

To conclude this section, it can be said that in the future there will continue to be this difference between the formal communication channels preconceived and the actual communication that is generated among the actors by necessity.

2.3.5. Challenges for the construction project manager

In the construction industry, it can be said that the success or failure of the project relies, more than in other sectors, on the skills of managers. The effort made by a manager has a direct impact on the satisfaction of the rest of the project team members. Pinto (1991) argues that one of its most important roles is to ensure this job satisfaction of other members and create positive relationships between workers and managers. These tasks present a challenge, of leadership and communication capacity, for the project manager, who has to ensure that his team is satisfied to obtain the best results from each of the members and thus meet the objectives (Pettit *et al.* 1997). In addition to these tasks, the project manager has to make decisions in accordance with the interests of the company for which he works. They are expected to communicate the values and principles of the company so that following this vision is achieved a collective success in the project.

In construction, the project manager is one of the most important actors for the correct delivery of the project. In fact, its role is to try to please all the parties involved, balancing their decisions. By working within a group that you have probably never worked with, the difficulty of your work is capital. According to Emmitt and Gorse (2003: 17), surprisingly little research has been done on the interaction between the project manager and the other actors involved. However, Turner (1998: 435) defines a series of leadership qualities that the project manager must possess:

- *Results orientation and problem solving ability:* Project managers must be intelligent and capable of analysing and solving the complex situations that arise in order to reach the desired objectives.
- *Energy and initiative:* Project managers must be able to work under pressure, while at the same time solving difficulties with initiative.
- *Self-assurance:* Project managers need to have confidence in themselves. They should not seem overbearing, but self-assured to convey the necessary confidence to the rest of the team.
- *Negotiating ability:* Project managers must be able to overcome negotiation to a possible lack of authority. They also have to negotiate with investors and lower their expectations if necessary.
- *Perspective:* Project managers, should look beyond the team and beyond how they influence in the organization of the company. They must be able to see beyond the immediate activities of the construction, in order to anticipate changes during the project and be able to anticipate problems to solve them in time.
- *Communication:* Another key characteristic of project managers is that they must be able to communicate clearly. They must be able to communicate effectively at all levels, from the investors to the fellows in the team. This interaction with the different members requires different communication skills that are very important.

It can be deduced from these skills that communication is linked to good leadership. Leadership qualities have a special significance in project-based sectors, as the project manager is a single integrative source of responsibility (Partington, 2003). The leader must effectively communicate the vision of what the organization is trying to achieve (Thompson and McHugh, 2002: 260).

Construction project managers to solve complex situations that will arise during the lifetime of the project must apply these leadership skills. These situations can be given at different levels, and according to Turner (1998: 16), the levels are as follows:

- *The Integrative level:* At this level, the objectives of the projects are defined together with the risks that are agreed to assume. It also defines the resources to use and the restrictions.
- *The Strategic or Administrative level:* At this level, the short-term objectives are defined, that is, the milestones that are wanted to achieve as the project progresses. It also decides the agenda and the calendar that helps to manage the project day by day.
- *The Tactical or Operational level:* This level defines all the activities necessary to achieve the milestones previously defined, with the responsibilities of all the parties involved and their tasks.

Each of these levels of management defines a number of challenges for the construction project manager. In relation to communication, at the first level, the manager should focus on communicating the vision of the project and ensuring that they have all the necessary and adequate resources to achieve the objectives. At the second level, the manager should emphasize in communicating that the stated objectives are possible and make clear the boundaries that define the project. The last level is more focused on the individual tasks so the manager should focus on convincing all participants that they have a key role in the project as a whole. The ability of the manager to move between these levels and be able to use correctly different communicative functions define him as a key role and one of the most demanded in the construction world.

2.4. Tackle the communication challenges within construction projects

The previous section has explained some of the problems faced by those involved in construction projects and in particular the managers who have the responsibility to deal with them. In this section, some solutions will be explored to face these challenges.

It has been previously described that a communication system combines the formal structure and the cultural and interpersonal interactions that are more informal mechanisms of

communication so that the employees feel informed, motivated and involved in the project. However, it is important to understand that establishing effective communication is not just about how information is transmitted from one person to another, but how it is interpreted, understood, and how it is acted upon. This is a particular problem for construction projects because of its decentralised and temporary nature of the team that forms it, which favours the misunderstanding of how information is ameliorated and interpreted.

Open and direct communications have not always been part of construction projects, traditionally because of conflicts of interest and contract types, communication used to be more secretive, with manipulative sharing. Today, no matter how effective the project manager is in managing communication within the project environment, employees will be dissatisfied if the situation is not effectively supported with effective communication.

Another plus point to add to the complexity of communication is the fact that construction projects are inherently a multi-organisational phenomenon. This is because there are many stakeholders involved and a collective effort is needed to get the project moving forward. The coordination of the inputs of these parties and management of production information inherently relies upon both formal and informal communication practices (Emmitt and Gorse, 2003: 91). Therefore, planning communication in a way that combines formal and informal practices is vital to achieving the objectives of the project.

For most project managers, their main concern and interest is to communicate effectively with their employees and encourage them to contribute positively to their tasks to benefit the group and the project. However, despite the problematic communication context of the industry's intra-team and inter-team communication environment, very little guidance is available that describes how to improve such processes within the construction sector (Cheng et al., 2001). This is surprising given the degree to which those engaged in productive activity are motivated depending on the effectiveness of their managers to communicate with them (Armstrong, 2001: 807). In response to this need, the basic pillars of an effective communication strategy that applies to temporary organisations such as construction projects will be shown in this section. These pillars are not a rule to follow, but they can be used as principles to help realise an effective communication strategy for the specific needs of a construction project.

Knowing the communication problems that exist in the construction projects, it is going to be shown below a series of practices to deal with these problems and try to ensure that effective communication is implemented within the construction project in a way that solves problems or at least minimise them.

2.4.1. Understand the structure

The first step in defining the communication strategy has to be to understand the structure of the organisation and support the communication network that is generated from it. Without understanding this, it is impossible for the manager to decide where to introduce solutions, if something is failing (Weinshall, 1979). Organisation charts are very useful for understanding the system. The *sociogram* specifically describes the relationships between project participants. The use of these techniques is very useful to highlight disagreements and misunderstandings among those involved. You can also create an organisation chart that compares aspects of employee interactions. This type of techniques are not usually used in the construction management sector, however, it is highly recommended to use it and that the responsibilities, contracts and communication channels are clearly defined for all those involved in the construction project (Hellard, 1995).

2.4.2. Favour the upward communication

In recent years, the importance of communication in organisations in general has been increasingly recognised and multiple articles have been published. In those articles, the most defended theory is changing order in communication, once a great deal was given to information sent by employers to employees, now feedback is gaining many supporters, attaching great importance to upward communication, that is to say, information that employees pass on to their employers. According to Torrington and Hall (1998: 114) this upward communication is vital for:

- Understanding employees' concerns.
- Keeping in touch with employees' attitudes and values.
- Alerting managers to potential problems.
- Providing managers with workable solutions to problems.
- Providing managers with information necessary for effective decision-making.

- Encouraging employees to contribute and participate with organisational decision-making, thereby improving motivation and commitment to organisational actions and directions.
- Providing feedback on the effectiveness of downwards communications.

In the past, employees communicated through representatives or unions, the most innovative ideas call for communicating directly with the workforce through individualized work contracts. Indeed, the decline in the significance of collective bargaining is likely to lead to increased direct communication in the future (Emmott and Hutchinson, 1998). This is why the new communication strategies that are emerging reflect the new social and work situation.

2.4.3. Measure communication effectiveness

Being able to study communication is a key step in identifying where improvements can be made that help make communication more effective. It is essential for construction managers to evaluate the success of their project's communication channels, to assess whether they are being effective for other projects, or to correct them if they are not working. In establishing methods for the industry to achieve this, a useful starting point is provided by the results of research undertaken by the Construction Industry Institute (CII) in the United States (see Tucker et al., 1997; Dainty et al., 2006). This research provides kind of a kit for the manager to be able to measure the effectiveness of communication in the project. This tool to measure the effectiveness was developed to use it during all the phases of which a construction project is composed and thus to improve the communication in it. The software used to measure effectiveness returns a score. After analysing the communication in seventy-two projects, six categories of communication were identified with a direct impact on the perception of those involved in the project and its success.

Table 3. Critical categories of communication

Source: Thomas et al. (1998). American society of civil engineering

<i>Category</i>	<i>Description</i>	<i>Weight</i>
Accuracy	The accuracy of information received as indicated by the frequency of conflicting instructions, poor communications, and lack of coordination	2.1
Procedures	The existence, use and effectiveness of formally defined procedures outlining scope, methods etc.	1.9
Barriers	Presence of barriers (interpersonal, accessibility, logistics, etc.) impeding communications between supervisor or other groups	1.8
Understanding	Understanding information expectations with supervisors and other groups	1.6
Timeliness	Timeliness of information received including design and schedule changes	1.4
Completeness	The amount of relevant information received	1.2

Statistical analysis revealed the critical categories of communication shown in Table 3. The weight of each category was developed to reflect the importance of each in effective communication. Thomas *et al.* (1998) argued that their study represents a milestone for engineering and construction projects in that it has identified and measured critical performance variables.

2.4.4. Favour process integration

Design errors, material failures or problems with the execution of tasks can lead to defects in the construction and have to rebuild. However, Moore and Dainty's (2001) work shows that communication problems often lie at the heart of all such problems. In addition, the separation of design and construction activities leads to confusing situations and difficulties in communication. In fact, Harrower (2003), Group President of the Special Engineering Contractors (SEC), stipulates that his member contractors and key manufacturers continue to be denied the opportunity to join design teams and therefore cannot contribute knowledge about value engineering, sustainability and whole life costs. He suggests that this lack of interaction leads to contractors having to redesign the previously designed and therefore it delay the work.

In order to eliminate the problems arising from the separation of design and construction activities, the latest articles on the subject emphasize the importance of integrating processes and involving team members in all activities. Egan report already summarized in 1998 some key features of integrated project process:

- The entire construction team is used, bringing together all the skills of the actors involved to meet the needs of the client.
- It is explicit and transparent, and therefore easier to understand on the part of the members of the project and the client.
- It entails an improvement in the efficiency of project delivery due to the elimination of the barriers imposed between planning, design and construction processes, traditionally separated.
- It promotes that the work does not cease, sharing always information between the designers, constructors and suppliers.
- It allows teams of designers, builders and suppliers to work together on more than one project, developing their capabilities together continuously, innovating and improving the product they offer.

Relations between members of the construction industry have always been limited by the boundaries between the mentalities of the various professionals involved in the project. Working together throughout the project and reaching understandings with each other thanks to effective communication is a great step to improve a very important challenge of communication.

2.4.5. Create the best possible teams

The construction industry, as explained above, is a project-based industry, and these projects need to be composed of several actors who must work together, and combine their skills and experience to create synergy and develop the project the best way possible. A team is formed for the purpose of bringing together complementary skills to achieve an outcome that could not be effectively achieved by a group of individuals (Rosenthal, 2001). When a team works together effectively, they achieve the desired results. These reasons are the basis of the high-performance teams. Effective communication is another key factor in creating high-performance teams. In these high-performance teams thrive in open communication

climates, where ideas and information are freely exchanged in a collaborative workplace environment (Huczynski and Buchanan, 2001: 875). Therefore, knowing that it is difficult to create a high-performance team in every project, trying to create the best team possible that is capable, because of the members experience and skills, of using effective communication and working together is another solution to avoid communication problems.

2.4.6. Understand and use the latest procurement practices

In recent years, the way in which projects are procured has changed noticeably, so has the way in which the participants interact with it. This is in part a reflection of the recognition of the value of effective human and organisational communication (see Cheng et al., 2001). Encouraging people to work together with other institutions to develop long-term relationships through strategic alliances breaks many communication barriers outlined above. However, this communication needs to understand the new forms of procurements that are being used in the construction sector and that for a long time have been ignored, because although the counterparts are the same, the way of relating has changed. For these reasons, understanding and managing interpersonal and inter-organisational communication are essential for future development and for this, it is necessary to understand and embrace changes in project procurement practices.

2.4.7. Improve workforce behaviour and communication skills

Communication is a key factor in establishing new ways of working necessary for a positive change in the construction industry. Communication is not merely a mechanism to convey or transmit information but is a tool by which workforce attitudes and behaviours can be challenged, manipulated and changed (Townly, 1994). In recent years, some construction companies have begun to recognise the power of 'softer' behavioural competencies in defining the success of an organisation (Moore et al., 2002). This recognition comes from understanding that personal behaviour in the development of a project determines its success. Such behaviours are manifested and transmitted in the ways in which the project participants communicate. Therefore, training, developing and helping people improve their communication skills is essential for improving project development and company development.

2.4.8. Integrate into the local culture

A popular theme in contemporary organisational communication concerns the need to adapt to competitive and dynamic markets (Huczynski and Buchanan, 2001: 203). The influence of international markets in the construction sector is becoming increasingly apparent. Emerging economies such as China's industry offer a huge potential market for European companies trying to expand. Taking advantage of these emerging economies should be a priority for those companies that want to expand, and therefore studying and understanding the intercultural communication protocols is an essential step to achieving this. Indeed, experiences in construction to date have shown that many managers of construction companies who work overseas are ill prepared for their role and experience significant cultural and communications problems with their subordinates and local management counterparts (Loosemore and Al Muslmani, 1999). Therefore, understanding the local language and culture to treat employees in a correct way, ensures strong and robust communication lines, is essential to generate a suitable work environment and to manage the complex problems that are generated in the construction projects that are being studied in this thesis.

2.4.9. Use of new communication technologies

Over the last few years, there has been increasing interest in using Information and Communication Technologies (ICT) to improve efficiency in the construction process (A.P. Chassiakos, 2007). This is because ICTs if used correctly, can substantially improve the time taken to carry out the project, its cost and the overall success of the project. The research made by Chassiakos (2007) on ICTs shows that the use of Electronic Document Management Systems (EDMs), Web-based Project Management Systems (WPMS), Application Service Providers (ASP), E-work and E-business, Virtual Reality (VR) applications, mobile computing, and wireless communication are beneficial to the industry.

EDMs have been developed to manage and store electronic documents, being able to store, modify, secure and retrieve them if necessary (Björk *et al.* 1993). WPMS combine databases with web technologies to manage and share remote information. Many contractors also use Project Specific Web Sites (PSWS) where they share information with their partners, customers, or suppliers. ASP are companies dedicated to the information technology that

provides computer services to clients of the construction world (AEC) through the internet. E-hubs are internet portals that work from company to company providing meetings for buyers and sellers in the sector. Virtual Reality (VR) in relation to 4D and nD modelling generates situations that combine 3D CAD with varied aspects of construction such as programming or costs (J. Whyte, 2003). Personal Digital Assistants (PDAs) or smartphones that are fully integrated into people's day-to-day activities are used in the industry to monitor operations and get real-time information about what is wanted while communicating information between the different places where the project is carried out or directly to make decisions without having to arrange a meeting or to be in the office. The teleconferences or video conferences is another very useful tool to facilitate the collaboration in great projects.

The solutions provided by the ICT have been shown to be very useful for the construction industry. However, it is necessary to establish a number of limitations and barriers when using them so that their acceptance and implementation throughout the industry is greater. Bellow will be shown some of the obstacles that must be taken into account according to A.P. Chassiakos (2007) when using the ICT:

- Construction is well known for its conservative attitude towards adopting new technologies. The biggest obstacle to ICT is the difficulty for the industry to modify its operating routes, increasing the cost of investment to implement them and hire qualified employees to use them.
- The effectiveness and usefulness of WPMS in construction projects still do not perform as expected, in part, because there are still many failures when using them because of the user's ignorance.
- The lack of information on the standardisation of ICT is another obstacle to the management of computer-integrated construction.
- Electronic commerce, although it has improved enormously in recent years, still have technological and funding limitations that limit its availability in some particular circumstances or with some customers.
- Although there is a wide variety of communication technology at the service of the industry, there are limitations due to its price for some individuals or companies.
- Although many companies are increasing their investment in ICT to gain a competitive advantage in the market, it is often not clear how much each company should invest and in what way.

Being aware of the limitations and barriers of ICTs, being able to use them correctly should be a priority in the sector to encourage communication among those involved in construction projects.

2.4.10. Use of good communication systems

Any organisation must have a communication strategy comprised of a series of communication systems, which form a secure and effective way of transmitting information between all levels of the company or the project (Dainty *et al.* 2006). Previously, new information technologies have been explained, and some examples of more traditional media that are still very much present in the sector will now be shown and should not be overlooked as managers continue to use them to transmit information to their employees or receive feedback on different topics:

- *Intranet systems*: most companies have intranet systems or their own email to transmit information to multiple people in a fast way. This way of transmitting information is cheap and effective; it also allows a project to transmit a lot of information quickly and allows employees to give feedback to their managers using the same system.
- *Magazines and newsletters*: this is a more formal system used in companies both to inform the public and to inform employees, it can include information about the company and the opportunities that are emerging in it, or the changes that are going to take place.
- *Notice boards*: although it is an old way of transmitting information, it is still in use, and companies use it to publish general information. Obviously, there is no guarantee that employees will read the message and information may become obsolete quickly, but it is still a cheap and effective communication system for certain issues.
- *Team briefing*: this communication system is based on small briefing sessions with some employees giving the opportunity to discuss or give feedback on problems that are occurring. Carrying out this chain process allows information to be transmitted to all levels of the organisation and that everyone can get informed and replicate on the subject being discussed. It is a good system for projects because it manages to overcome the barrier of having members scattered on different levels.

- *Focus Groups:* These types of groups bring together people from different levels of the company to discuss issues of mutual relevance. In these meetings, the debate is promoted around the problem that is being studied inviting to give their point of view, creating a global vision from different positions that facilitates its resolution.
- *Staff surveys:* this system, which is done by questionnaires anonymously, in most cases, aims to collect information from the point of view of employees; this allows to give their opinion without being afraid about the possible retaliations.

It is important to use a combination of these communication systems together with the ICTs, and not to focus only on one type of system, to create an effective communication strategy in any type of organisation.

2.4.11. HRM supporting effective communication

In contemporary organisations in general, forms of communication are an enabling element for many aspects of the functions of HRM. Communication is an important factor in motivating workers, essential to keeping them informed, happy and involved. It is also essential to avoid misunderstandings that is often the root of many of the problems in the construction industry. The latter case in particular is very important in construction projects, since communication plays an important role in influencing the opinion of employees. Maintaining an open and secure communication culture fosters trust among employees at all levels of the business. Finally, good practice in many areas such as occupational health and safety, equal opportunities and training are also reliant on effective communications between key stakeholders (Loosemore et al., 2003). Two important HRM policies that can be used in the construction sector to promote effective communication between employees and their participation are:

- *Performance Management and Reward:* a reward system communicates a message to employees about company values and encourages these employees to communicate in ways that support the objectives of the company or project. Managers can be helped in their communication responsibilities by reward systems and / or sanction, which encourage the types of behaviour considered desirable (Huczynski and Buchanan, 2001: 200). For example, if employees working on the construction site are rewarded for sharing their knowledge and information about any

new ideas they may have had or some innovation of a task, employees will try to put more emphasis on what they are doing. Likewise, if employees are encouraged to communicate through organisational levels for the sake of the project and are rewarded for improving project outcomes, an environment will be created that will favour effective communication within the project team favouring the results and interests of all parties, in the current project and in the future ones.

- *Employee Involvement, Participation and Empowerment*: the concept of employee involvement, participation, and ultimately empowerment has grown throughout the 1980s and 1990s, largely in response to reduced union power and government policy that evolves arrangements that suited their needs (Wilkinson, 2001). Allowing employees to have more control over the work they do is a good way to optimise their contribution to the project. The management initiatives used to improve the work environment have gained popularity in recent years in the construction sector because they help ensure those employees' opinions and perspectives influence and help the company to move forward in the good direction. Some of these initiatives are the quality customer service improvement schemes, quality circles or Business Process Reengineering (BPR).

2.5. Summary of the literature review

The objectives of the literature review were to understand the communication in the construction projects, to identify the communication challenges in the projects and to see how these challenges can be tackled.

To achieve these objectives, a large number of articles on communication in construction projects have been studied. Those most relevant have finally been used to explain the current situation of communication in the construction sector.

The literature review has begun with a first section that introduces communication in the construction sector. Communication has been defined and the importance of effective communication has been explained.

In the next section, an analysis of the communication within the construction projects has been carried out. What networks and structures are created in the projects and the importance of the individual behaviour involved in the project.

The third section discusses the communication challenges and problems that arise in construction projects. The very nature and difficulty of the project, the barriers that are generated both within an organisation and between organisations. Finally focusing on the figure of the project manager the challenges, he has.

The last section of the literature review explains different solutions to the challenges of effective communication in construction projects. Understand the communication structure in the project. Favour upward communication. Measure communication effectiveness. Favour the process integration. Create the best possible work teams. Understand and use the latest procurement practices. Improve workforce behaviour and communication skills. Understand the local culture where the construction project is being carried out. Use a good communication system, taking into account the new technologies of information and communication. Finally, the human resource management defend and encourage effective communication.

The reason for this analysis is to establish a basis to judge a posteriori the results obtained in the empirical study, if they tally or not, with the previous studies. The empirical study based on interviews will present its results in the next two chapters of the thesis. Both the interview questions and the way of approaching them are directly related to what is researched in the literature review.

3. EMPIRICAL STUDY

After analysing the existing literature on communication problems in construction projects, this chapter shows the empirical study that has been carried out to study in a practical way what has been shown during the first part of the thesis in a theoretical way.

The empirical study will consist on analyse real situations, by analysing viewpoints of different actors with a wide experience in the construction sector. The goal is to analyse the communication tools and practices used and explore the communication problems between the actors in their construction projects. The experiences of these actors in different construction projects will serve to corroborate or deny what was explained in the analysis of the literature.

This study conducted through open-ended interviews where things are discussed without having a fixed response is a qualitative research, which will be explained below.

3.1. Research approach and process

Qualitative research is one that develops explanations about social phenomena. It could be said that it tries to help understand the world we live in and why things happen or are, the way they happen or are (Degu and Yigzaw, 2006). This type of research relates to the social aspects of our world and usually tries to answer questions such as:

- Why do people behave the way they do?
- How are opinions and attitudes formed in the face of different situations?
- How are people affected by the events that happen around them?
- Why have cultures developed the way they have?

In general, qualitative research attempts to answer questions that begin with Why? How? or In what way? This is one of the main differences with quantitative research that focuses on questions such as How much? How many? How often? etc.

The communication problems that are being studied in this thesis cannot be summarised in this way. It is necessary for the participants to show their points of view, and as has been explained long and hard, the construction projects are unique and the problems that occur in one cannot be extended to the next. This is why this issue is so complicated, we must analyse

one by one the problems that have arisen in a given project that has developed in a certain way and try to find a common pattern in the projects to achieve a system or generic practice that tries to prevent this type of particular situations.

3.1.1. Sample of respondents

As Blackstone (2012) research states like in quantitative research, also in qualitative research, the collection of information is done from sampling designs, since in most cases it would be impossible to gather information from the entire population under study. However, there are important differences in the preparation of a sample in both approaches. The main difference is that qualitative research is usually done with non-probabilistic sampling. In quantitative research, one of the main objectives is to be able to perform statistical inference, that is, to be able to generalise to the entire population the results extracted from a sample. For this reason, it is necessary to perform probabilistic sampling, in which the fundamental condition is that all the subjects related to the topic studied have the same probability of being part of the sample finally chosen. In qualitative research, not the entire population are likely to be part of the sample.

The different types of sampling according to Degu and Yigzaw (2006) that exist in qualitative research are:

- Intentional or of convenience: The people to be interviewed are chosen according to criteria of the researcher's desirability or the objectives of the research (richness of information in the case, position that he occupies in relation to the phenomenon studied, etc.).
 - The "snowball" strategy is often used. We find a key informer, and this one identifies whom to interview, and so on.
- Of extreme cases: Selection only of those cases that are in the ends of the range of a variable.
 - Especially useful when trying to know the boundaries of the action to be studied, but presents difficulties in face-to-face interaction.
- Of rare cases: Selection of those cases whose values in the range of the variable are infrequent. It does not imply that they are extreme.

- Useful in contexts or problems of high social conflict to discover consensus discourses or sets of action.
- By quotas: It presupposes discursive variability according to certain parameters of the population. The use of control variables is frequently used as a stratification criterion.
 - As a difficulty, the design is complicated when working with more than three control variables (multiplicative function).
- Structural: Selection of individuals by virtue of connected positions within a structure or chain.
 - Useful in the study of hierarchical social structures or communicational dimensions of problems.
- Critical cases: Selection of cases that can serve as a logical reference for the rest of the population in relation to the topic of study.
 - Useful for addressing emerging or prospective problems.

In the study the selected sample of participants is based on the convenience or intentional sample, explained above, where survey participants are selected based on their availability. Those individuals who show interest in interviewing and are willing to do so as soon as possible are those who have been selected to participate. Increasing slightly the above information, the advantages of this type of sample are:

- First, convenience samples are easy to carry out, as they have few rules that determine how they should be performed.
- The time and cost required to choose the sample is much lower than that needed to perform a probabilistic sample.
- Finally, this method is appropriate for the type of study that is being carried out since it focuses on a series of individuals totally related to the construction sector and accustomed to work on diverse projects.

Although the sampling method has some advantages, it is not perfect. Convenience sampling can cause a number of biases and is not likely to be representative of the population as a whole, and because of that, caution should be exercised in interpreting the nature of the results. (SAGE, 2008).

Participants have been chosen from a list made for the author's knowledge. Taking into account the diversity of the participants and choosing actors involved in different construction projects and in different positions. In the end, twenty people were contacted from three different countries, Brazil, Finland and Spain. Just twelve could participate in the study, eleven Spanish and one Brazilian.

The size of the sample is by no means extensive. Given the limitations and knowing that, the sample is very small compared to the number of projects and people involved in the construction industry. It is not intended to provide a definitive solution nor generalize in the observations made in the interviews. Simply, contribute and analyse a series of real situations that are given in the construction projects to know how they have affected the actors involved and how they have tried to solve it.

3.1.2. Conducting interviews

The majority of interviews have been conducted by Skype, this tool has been chosen because of the comfort it entails, saving time for both the interviewer and the interviewee, thanks to allowing the interview to be carried out without the need to travel to face the interview.

All participants were informed prior to conducting the interview via mail. Where they were explained the study that was being carried out briefly. The participants were also asked about their availability and the interview questions were included in the mail so that they could think about a specific project, anecdotes, problems, etc. before the interview.

The interviews generally had a duration between 35 and 65 minutes and were conducted between the end of March 2017 and the beginning of May 2017 at the time chosen by the participants.

In the next section of this chapter, are presented the interview questions that have been made to different actors, belonging to different companies and professions, involved in different construction projects with different budget, scope and organisational structure.

3.1.3. Interview questions

- I. Tell me about yourself, your background, education, career etc.
- II. Tell me about your last project, its product/target, the organisation, schedule, delivery method etc.
- III. What communication practices have been used in the project? Who has used which practices?
 - a. Which are the formal practices/tools? Which informal practices have you used?
 - b. How has the use of the practices evolved during the project lifecycle?
 - c. To which specific communication need, each practice has been used?
- IV. What kind of changes has occurred during the project?
 - a. How have those changes affected the normal development of the project?
 - b. Which were the actors most affected?
- V. Which are the identified problems in communication during those changes?
- VI. Which are the tools or practices that you have used to deal with these problems?
 - a. Which ones have been successful? Give examples.
 - b. Which ones have not been successful or they are missing? Give examples.
- VII. After all, in general how would you describe the success of communication in the project?
- VIII. What else you want to say about communication in this project?
- IX. Do you have some material/documents about the communication in the project, which you could share with us
- X. Who other individuals in this project we should interview?

3.1.4. Analysing data

All the interview questions have been designed by the author of the thesis based on the information obtained from the literature research. As previously explained, the intention is for the interviewees to have the opportunity to talk as long as they think and fit on each topic that is raised, so it has been tried to make the questions as open as possible.

In order to analyse the data the interviews are recorded with the knowledge of the interviewees to have access at all times to the answers and later to obtain results and graphs more comfortably.

The first step for the analysis is to organise the data. Identifying and differentiating between the key questions to accomplish the principal objectives of the thesis and those questions that are important for the interview but not essential. The data is organised in a way that is easy to look at, facilitating going through the topics to pick out concepts and themes. The next step is finding and organising the ideas and concepts found in the answers. Looking at the responses and finding specific words and ideas coming up in different interviews. After categorising those ideas, it is important to analyse the whole theme behind the idea to understand better what the interviewee wants to state. The last step of the analysis is to ensure the reliability and validity of the data analysis and the findings. This final step is made by comparison between the interviews and with the findings obtained in the literature review.

3.2. Analysis and findings

In the following section, the results of the research are presented. The section is divided into subsections following the main questions of the interview.

Firstly, a look at the respondent's background. After that, a brief explanation of the different construction projects where they were involved. The third and fourth parts will be the communication tools and practices used in their projects, both internal and external. The fifth and sixth subsections explain the main changes during the development of the projects, followed by the problems arisen and it will be presented the solutions that the respondents made to solve them if possible. The last section of this chapter will be the overall communication assessment made by the interviewees in the construction projects.

3.2.1. Respondents background

To get an idea of the sample interviewed. In this section will be presented a series of figures related to the background of the interviewees. Data such as gender, age, studies, profession, years working in construction, type of company in which they work... will be shown below.

The following figures show, respectively, the age of the interviewees and the years they have been working in the construction sector. An attempt has been made to interview people in

positions of leadership, responsibility, with experience, to know a mature and expert point of view.

As shown in the Figure 5 the majority of respondents are over 50 years old, only two are below and there is no interviewee who falls below 40 years of age. This shows kind of, what has been discussed previously; there is a lack of generational change in the sector, as well as a relay of practices and tools.

It is true that cannot be pretended that there are young people in their twenties in positions of responsibility, but in general, a greater number of young people are being missed, working in the field of construction management concretely.

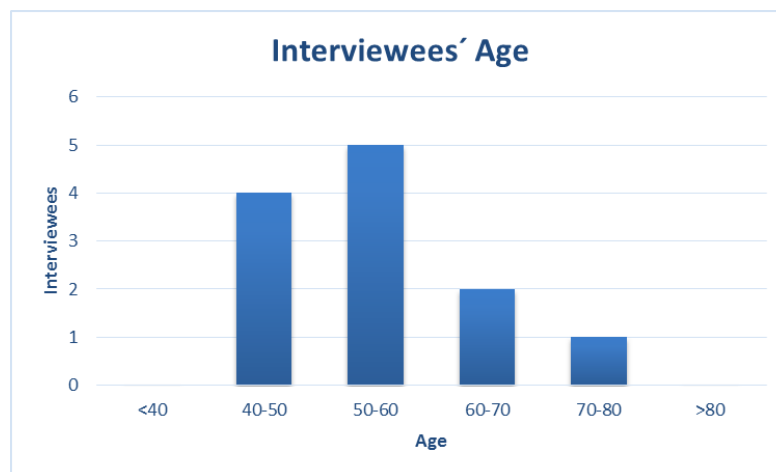


Figure 5. Interviewees' age

Source: own

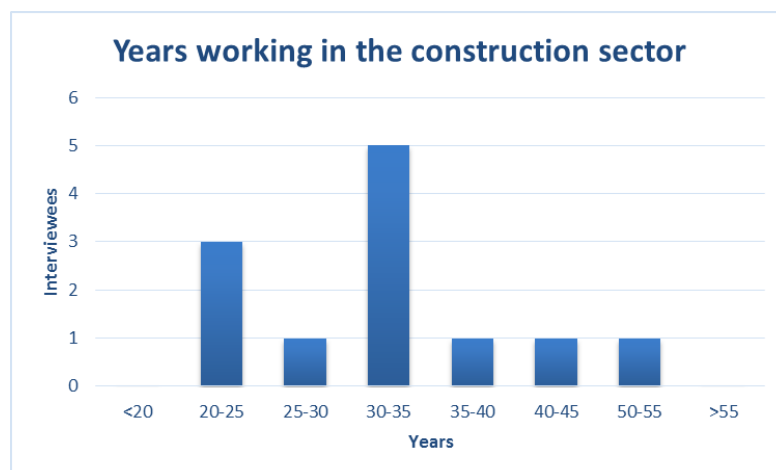


Figure 6. Interviewees' years working in the construction sector

Source: own

Having made clear the age and the experience of the interviewees, Figure 7 and Figure 8 show their gender as well as their studies. While gender is significant and can be extrapolated to say that, the world of construction is a world nowadays mostly of men. The interviewees' studies are directly related to the author's studies, which has managed to communicate more easily with civil engineers. Therefore, it could not be said that in construction there are usually more civil engineers than architects. Clearly, both professions are equally represented in the construction sector. Although it is true that the presence of the architects is similar to the one of engineers in construction management positions, in technical consultancies or in construction companies the presence of engineers is clearly superior.

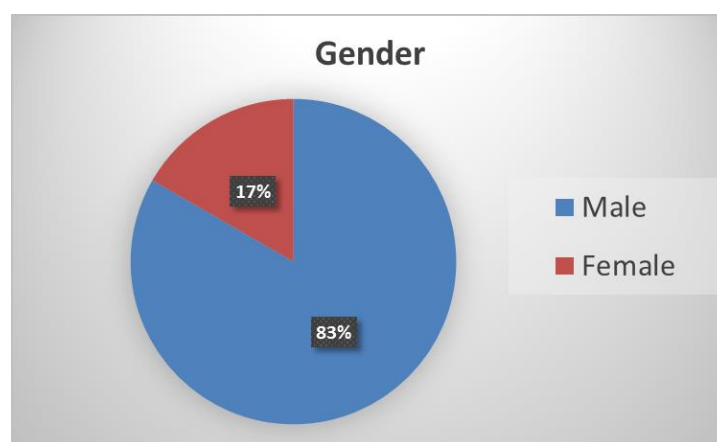


Figure 7. Interviewees' gender

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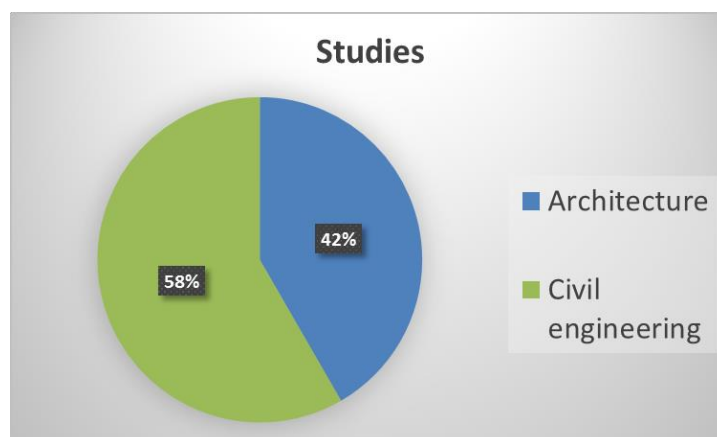


Figure 8. Interviewees' studies

Source: own

The last figures on the background of the interviewees, Figure 9 and Figure 10 show the interviewees' profession and the type of company in which they work. It is important to

know their professions to understand the role that they play in their construction projects. In addition, the author has tried to find as much diversity as possible, to have opinions and experiences in construction projects from different points of view. This way it has managed to have a good diversity and the interviewees belong to technical advice companies, architectural studios, construction companies, project management companies, real state and developer companies and finally, freelances. As can be seen in the figure the vast majority belong to the Project Management Team. Being half of them the Project Manager itself. The next most represented profession is the Construction Manager followed by just one Head of the Project Design Team and one Structural Engineer.

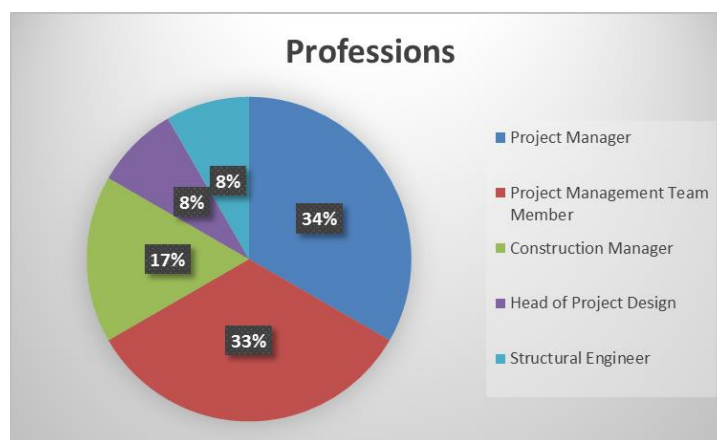


Figure 9. Interviewees' professions

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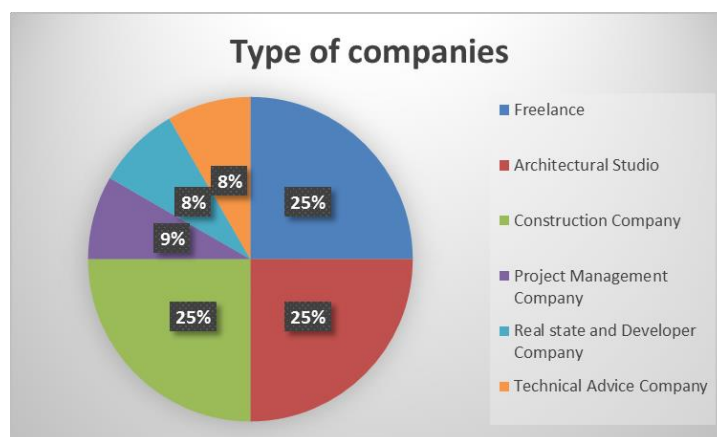


Figure 10. Type of company in which the interviewees work

Source: own

3.2.2. Construction projects

At the beginning of the interviews, the interviewees were given an opportunity to explain briefly the project in which they have been involved and in which the interview part about communication will be focused. The idea of focusing on a specific project and not doing a generic interview about communication is due to the fact that by focusing on the anecdotes, respondents better remember the problems that have arisen during the execution of the project and the way in which they have been solving such problems. Consequently, at the end of the study, 12 construction projects have been analysed.

Figure 11 shows the percentage of construction projects pertaining to civil works and those belonging to the private sector of housing construction. As shown in Figure 12, all construction projects are quite recent, delivered over the last decade. Therefore, the problems encountered in the projects are current problems, the communication practices used are perfectly valid and in general, all the anecdotes that the interviewees have wanted to share are a perfect example of the current situation of the construction sector.

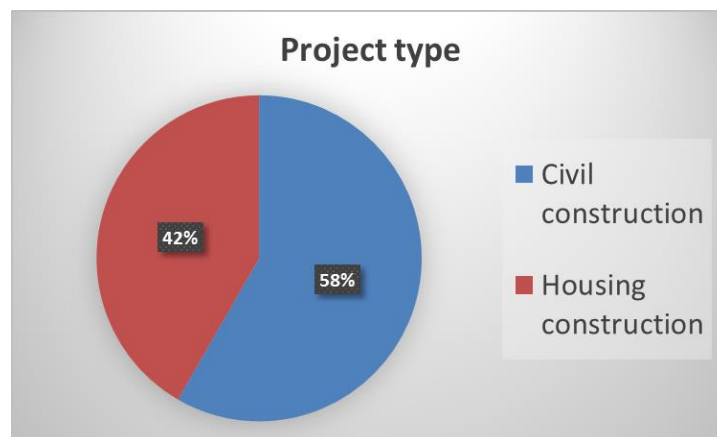


Figure 11. Project type

Source: own

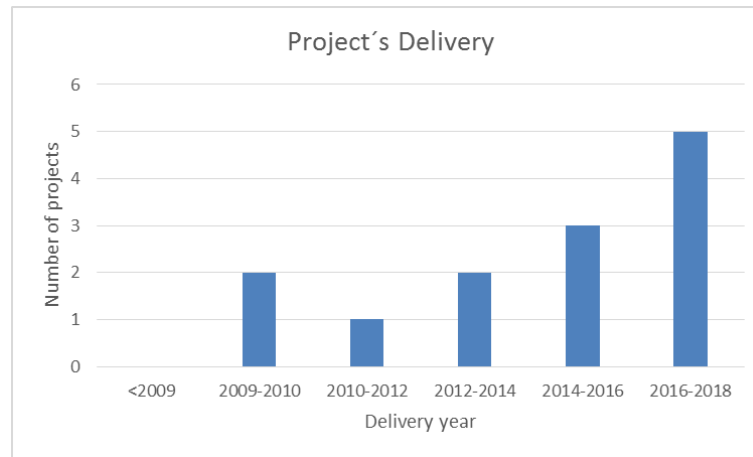


Figure 12. Year of project's delivery

Source: own

To finish with this section will be briefly explained the twelve construction projects that have been studied.

1. Construction project that consists in building protection measures for two historical forts in Cartagena de Indias, Colombia.
2. Project to enlarge and rehabilitate a museum in Valencia, Spain.
3. Rehabilitation project of an industrial warehouse to install an auditorium in Valencia, Spain.
4. Project to extend a road bridge saving a railroad track in a municipality of Barcelona, Spain.
5. Construction project of a private family home in and around Valencia, Spain.
6. Project management during the construction of a container port in Panama.
7. Project to build an urbanisation of 32 luxury villas in Ibiza, Spain.
8. Construction project of 111 households in Foios, Spain.
9. Construction project of a private family home in Torrente, Spain.
10. Conservation project of 80 km of road in Catalonia, Spain.
11. Construction project of a canine recreational centre in Madrid, Spain.
12. Construction project of a residential building in Zaragoza, Spain.

3.2.3. Internal communication tools and practices

In this section, it will be explained the most common communication practices that have been used internally in the companies involved in the construction projects mentioned above.

It will be in the next section, where the communication relation with the external companies and stakeholders involved in the construction project will be explained.

Within the tools and practices of internal communication, it can be said that there is a large group of respondents who maintains the traditional or more common practices and a couple of interviewees who use more modern and innovative tools and practices.

The common internal communication tools are as follows. Everyone uses the e-mail formally to communicate within the company. Another common tool is the smartphone and the instant messaging services like WhatsApp. Usually, they are used for informal and immediate communication, although work-related. Returning to the use of e-mail, there are various practices, among which highlight the use of a system of colours by the team members of a particular project, to understand better who formulates the questions and who gives an answer to a specific problem. Following the common internal communication practices, all the interviewees also hold periodic meetings of different kinds. The most important meeting that is widespread in relation with communication is a meeting before starting the project development, called a communication-monitoring meeting. In this meeting, all the participants of the project from the company in question meet to make an initial estimate of the structure of the communication. How it is going to be done, who is in charge of communicating with the external agents and how it is going to work in relation to the management of the documentation generated by the project. The remaining meetings throughout the project are usually done with the rest of the external stakeholders and will be described in the next section, corresponding to external communication. It is curious that only one of the interviewees has told the author about meetings to follow up the work done, but internally. This weekly meeting tries to verify that everything is being updated, is part of a system of a practical modern communication and will be explained in depth below.

Focusing on the innovative practices of internal communication, we find the following. Two of the interviewees use a management system based on Lean techniques called Last Planner System in their respective companies. This system serves for much more than to manage communication and especially implements improvements in the management of documentation both internally and externally that will be discussed at the end of this section. Specifically, the interviewees who have talked to me about this management system in addition to using the usual communication practices mentioned above hold a weekly meeting

to monitor the work of each of the employees. What must have performed and what must perform the next week. They argue that, unlike the traditional way of working in construction, which would be to seek to meet monthly objectives. This way of working, which has a much more exhaustive control, with daily information on the percentage of the fulfilment of the tasks, allows to manage the changes in a much more efficient way and to anticipate to future problems, trying to solve them day by day instead of waiting at the end of the month.

So far, has been explained how to communicate internally in terms of oral or written communication, traditional communication and in which everyone thinks when asked by communication. However, as has been explained throughout the thesis, there is another type of communication, internal or external, very important in construction projects. This communication is the communication of documentation and how this documentation is managed. Equal or more important to the success of the project than mentioned above. In this form of communication called documentation management, one can notice much more the advance and the use of new technologies.

Within the internal documentation management, the participants of the interviews use various practices. In smaller companies, it is common to use file transfer programs such as Dropbox, Drive or WeTransfer. It is also very common to have an own server or an intranet system, in which all the computers are connected and thus favour the rapid transmission of documents. Of course, each company manages the files inside the shared folders in different ways. Normally a personal folder numbering system is used within each project to identify each of the versions of the document and to know, at any time, which is the most updated version in which to work. The reason for this numbering is that it is common to keep the original file and make a copy of the new one in case you are wrong about something and you need to return to the original to remedy it. Also in this type of practice, it is usually done with change control, to know internally who has been the last to modify the file and to know both, what has been added and what has been deleted.

In larger companies, respondents say that this type of practice is prohibited by company policy. The company's computer experts recommend not using these systems because it is very difficult to control as far as virus entry is concerned. If all employees have access to shared folders, if they are not manage with proper use, the integrity of the folder may be

violated and several computers become infected. In these companies, all the file transfer is done via email, or if the documentation is too large it is physically transferred by external hard disk delivery.

Only a couple of the respondents have explained that they use BIM (Building Information Modelling) systems. Using this system, documentation management is much faster. The program connected to the company itself generates all the necessary documents and plans every time something is updated, without having to modify the documents one by one. It can be extrapolated that the use of this technology, although it is increasing, is still far from being strengthened in the construction sector. While it is true that this type of software is not available to all companies, the truth is that its lack of use is largely due to ignorance of the operation of the software. It is difficult to find nowadays, outside of specific masters, courses in the common university degrees where this technology is mentioned, as well as the Lean techniques, something that should be corrected in the face of the advance of the construction sector.

As a resume, in Table 4 all the internal communication tools are categorised. The formal and informal tools, those more common, and the unconventional ones.

Table 4. Internal communication tools

Source: Own

Formal tools		Informal tools	
Common	Uncommon	Common	Uncommon
E-mail Data transfer programs Intranet System Meetings with minutes	Procedure manual Last Planner System BIM	Phone calls Instant Messages Meetings	

3.2.4. External communication tools and practices

In the same way as within internal communication. To communicate with external agents out of the company, tools like email, phone calls, instant messaging applications and periodic meetings are the most common. What changes about these communication tools in most cases are the practices that surround them.

It has been explained for example that related to emails, some used a colour system to better identify questions and solutions to problems. Although this is done internally in the company, the most common practice with emails between companies or with the customer is to register and store them so that everything is recorded. Basically, this is the main difference in external communication with the internal one, the concern that all the conversations and everything that is said are registered somewhere. That is why it is tried not to abuse of telephone calls to solve important issues; meetings between the stakeholders involved in the project begin to take force.

With relation to meetings, there are many different practices. Among the interviewees, there are those who prefer to be held in their office for convenience, others who prefer that the meetings be carried out on site. There are those who like that the more people are involved in the meeting the better and those who prefer that only the necessary agents are present. Then they are the ones who communicate the decisions that are taken to the rest of their work group, for example. What is a common practice in all cases in these meetings is to write a record, a minute, at the end of the meeting, which collects what each member, has said.

There are different ways of writing minutes; in general, the interviewees think that the most effective thing is to follow an order of the day realised the previous week. At the end of the meeting in the minutes, the topics are write down, also how they will be resolved and the most important when, since in the construction world time is a key factor. All the participants of the meeting must sign this minute, giving their consent to the solutions that will be carried out.

Moving onto other types of usual communication practices that are more related to construction companies and subcontractors of specific work tasks. It is usual to have a manual for the execution of the different work tasks. This manual is distributed at the first meeting with the subcontractors so that they know in detail the usual procedure of the main contractor company.

Practically all the interviewees work in the same way, the communication is done in a triangle between the promoter or the client, the construction management and the construction company. The promoter and the construction company are the same agents in some cases, in the end, that simplifies the communication structure, but the principle is the same.

Only one of the interviewees varies the traditional way of proceeding. The same who applies Lean techniques in his company. The idea is that instead of performing a triangle communication, the communication is done linearly as shown in Figure 13.

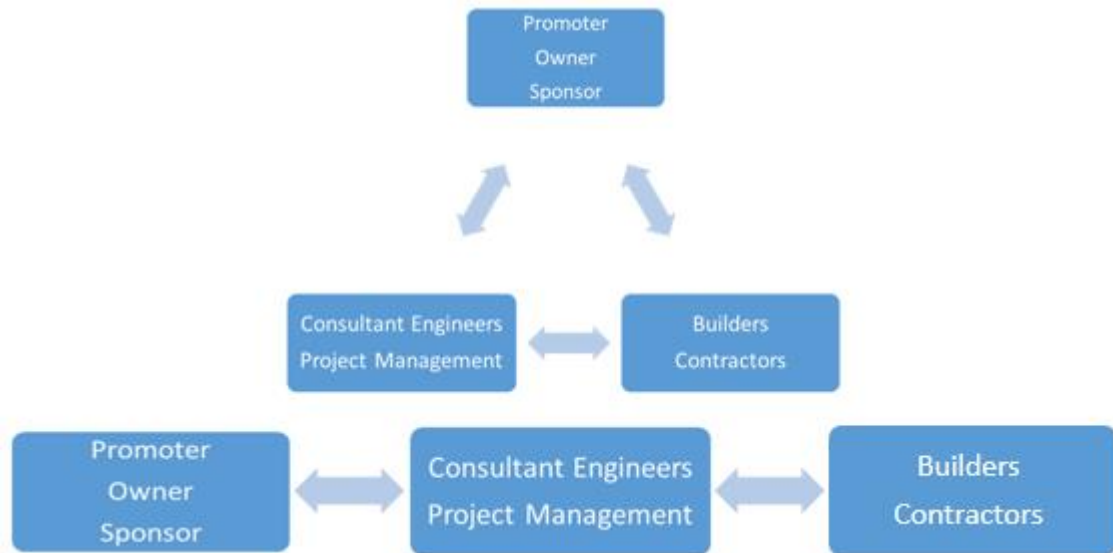


Figure 13. Traditional triangle vs linear communication in construction projects

Source: own

The communication between the client and the constructor is totally closed. It is explained to the client that he must communicate exclusively with the construction management, which in turn communicates with the construction company. What it is intended working in this way, is that the client does not interfere with short-term work, and if there is a need to make any changes, it is transmitted to the site management and planned with sufficient time to complete the construction. In this way, the client is prevented from interfering, so to speak, with the normal course of the work.

As a resume, in Table 5 all the external communication tools are categorised. The formal and informal tools, those more common, and the unconventional ones.

Table 5. External communication tools

Source: Own

Formal tools		Informal tools	
Common	Uncommon	Common	Uncommon
E-mail Data transfer programs Meetings with minutes	Procedure manual Last Planner System BIM	Phone calls Instant Messages Meetings	

3.2.5. Project problems and disputes

Due to the diversity of projects in which the participants of the interviews have been involved, the problems and disputes that occurred during the development of the projects are also very varied.

In this section, the problems faced by the interviewees will be described briefly in Table 6. After that table, the author will comment more deeply the problems. As the reader will observe, there are problems that recur or have a similar origin seen from two points of view, so this section will conclude by collecting these common problems. Solutions to such problems, if any, will be discussed in the next section of this chapter.

Table 6 will classify the problems as serious or minor issues. This classification is done based on the importance that interviewees gave to the problem. The author will explain deeply after the table if agrees with that relevance.

Table 6. Projects' problems

Source: Own

Project	Serious problems	Minor issues
Forts' protection measures	Intrusion of an external consultant Colombian company	-
Museum's rehabilitation	Personal problem between the project manager and the site manager The builder gives a very tight budget for the construction to win the contest	Outdated documents Informality of the meetings
Auditorium	-	Outdated documents
Road bridge's extension	Demonstrations due to the temporal closing of the bridge	Respect the conventions of the numbering system
Single family home	The promoter wants to make changes once the construction has begun	-
Container port	Crash of cultures, very complicated customer	Misunderstanding due to speak in a foreign language
Luxury urbanisation	Lack of communication between the commercial management and the construction management	Outdated documents Informality of the meetings

111 Households	-	Fewer and fewer follow-up meetings were held by the rush.
Single family home	The promoter wants to make changes once the construction has begun	-
Road conservation	-	-
Canine recreational centre	The builder gives a very tight budget for the construction to win the contest	-
Residential building	-	Unforeseen changes Outdated documents

In the first project that was held in Cartagena de Indias, Colombia and in which the interviewee was part of the project management team. The development of the project was as established until the main problem emerged within a few months of starting the work. The Colombian promoter company decided to include a Colombian consulting company, which reviewed all the decisions made by the Spanish management. This intrusion of an outside company did not like in the Spanish directive, they saw how each step they were taking was judged and that increased considerably the disputes during the development of the project.

The second project was a rehabilitation of a museum, in this project the interviewee was the project manager. The main problem, in this case, was personal. Due to continuous boycotts by the site manager, who jumped the project manager talk directly with the promoter and introduce various changes in the execution of the project, the relationship between the construction management and the construction company was totally broken.

The project of rehabilitating a warehouse to turn it into an auditorium was kinder than the previous two. In this project, the interviewee was part of the project management team and the only problems that stand out are isolated cases of outdated documents. For example, external companies that did not share a server with the architecture studio sometimes worked with old versions that were not the last one. A common problem as will be seen later.

In the project to extend the bridge in Catalonia the development was quite quiet. The critical moment occurred in the period, in which for constructive reasons, the bridge had to be closed to the traffic permanently until the corresponding works were finalised. The people from the village, to which this bridge gave access, became very nervous and there were a series of demonstrations due to the detour that they had to realise to be able to accede to the town.

Projects related to the construction of private homes can be put together in one. The problem that arises is always the same. The promoter or client, who is not a technical person, during the project development, imagines a situation seeing the construction plans of how the house is going to be. Later, with the work already in place and all the planning done, the client really visualises the physical space and wants to make changes. There is a very common saying that whoever pays, rules. Therefore, all the changes that the client/developer wants to introduce once construction has begun are a problem.

Let us now recall the project on the management of a container port in Panama. The interviewee was hired to do a market study and then carry out the corresponding works at the port. The promoter was a Chinese customer. The main problem in this project was the clash of cultures, as mentioned before cultural differences bring many problems and in this project, these differences were taken to the extreme. The result of a different way of working and not understanding with the client, led to a total breakdown of communications and a default by the Chinese client after the delivery of the market study, by which the Spanish manager abandoned the project.

The last project that its communication problems will be discussed is the luxury urbanisation in Ibiza, Spain. In this project, the interviewee is part of the company that is both promoter and builder. The construction of the villa is done after it has been sold to the client so it is completely customised and the only thing the company outsources is the construction management. The interviewee explains that communication in the construction project was exemplary between the project management team and the construction company, with some

minor problems. Instead, he explained that the communication between the commercial management in charge of selling the villas to the private individuals and everything related to the construction was an absolute disaster. He commented that there were many changes agreed with the client in meetings in which no minutes were made that were not transmitted to the project manager. This means that they realise of these changes due to customer complaints and had to make many corrections on the construction already done having some extra high costs in some cases.

So far, one can observe the most serious and particular problems of each project, fortunately there are projects without important problems throughout the development of them. Before completing this section, the author will make an overall assessment of the common projects summarised in Table 7.

Table 7. Common problems

Source: Own

Common problems		
Documentation management	Informality	Strong budget cuts
<p>Outdated documents</p> <p>Disrespect for the conventions of the document transfer system</p>	<p>Realising meetings without minutes</p> <p>Important solutions or agreements not recorded</p>	<p>Introduction of changes</p> <p>Ignore the project manager</p> <p>Reduce qualities</p>

The author has realised that there is a widespread problem with documentation management. Practically all interviewees comment that at some point, someone has been working on old versions of documents, or that suddenly in worksite; different task managers were using different construction plans. This lack of rigour in the updating of documents as important as construction plans is commented as a normal thing that always happens. The interviewees commented that during the execution of a work, it is normal that huge amounts of documents are generated and there are some misunderstandings with them. The author of this thesis thinks that this generalised passivity on such an important subject should not exist. The

updating of documents is vital and at all times having the right construction plan to work with saves a great deal of time and extra costs.

Another generalised problem of communication is derived by the informality of many of the meetings that are realised during the development of a construction project. At least in Spain, it is quite common as well to hold the corresponding official meetings on site, to hold meetings in cafes or restaurants while drinking something or staying to eat. In these meetings, of course, no minutes are recorded and happens more or less the same as when delicate situations are resolved by telephone. By not recording what has been talked about, there are many misunderstandings afterwards. The parties involved finalise the meeting thinking each one that has been clear a subject that was wanted to settle, without knowing if the other party has understood it in the same way. This occurs in meetings in which the same language is spoken, in meetings of international projects such as one that has been explained in this thesis; the participants try to speak in a language that is not their native language. Therefore, the way of expressing varies a lot and the misunderstandings in this type of meetings grow exponentially.

Finally, there is another type of practice that the author considers very harmful to the construction project and which seems to be also widespread. Commenting on the general situation of the construction sector in the interviews, some of the interviewees have shown their discomfort with a concrete practice carried out by construction companies. It is very common that the construction companies win the bidding competitions carrying out very strong budget cuts. The practice means that the development of the project becomes a war between the management of the project, which defends quality standards that he believes, are admissible and that for that matter are chosen in this way and the construction company that seeks to reduce the maximum costs of construction, in order to obtain the maximum possible benefit. The construction company tries to convince the developer that the qualities it offers are the same as those that it puts in the project but much cheaper, while the construction management defends that its qualities are much better and that nothing should be changed. This tug-of-war in the development of construction results in a myriad of problems and greatly affects communication. Tested in some of the projects described above, where the situation has been taken to such an extent that the communication between construction management and the construction company has been broken. One of the interviewees affirms that this is an evil endemic in Spain. It must be stopped from the

beginning, getting the construction management a full support of the promoter, in order to avoid that the construction company wants to be reducing costs at any time for having made a drop in the bidding process to win the contest.

These most specific and most important problems are found among the projects that have been analysed. These problems derive or affect communication directly in the construction project. The next section will explain one by one, if it has been possible to solve them and if so, with what practices have been solved or if not, how it has tried to solve without success.

3.2.6. Solutions

In this section, as was done in the previous section. The author will first explain in Table 8 the consequences of the problems explained above and the tools and practices that were carried out in each project to solve these problems. The section ends with a series of general solutions that several interviewees have proposed to the communication problems in the sector.

Table 8. Solutions for the problems arised

Source: Own

Project	Consequences of the problems	Solution	Problem solved?
Forts' protection measures	From collaborative communication to confrontations	Intensification of calls and e-mails More visits to Colombia Ask the promoter to act as a mediator	Yes
Museum's rehabilitation	Ignore project management in decision making	Increase meetings	No

	<p>Decrease in project quality</p> <p>Total breakdown of communication between project management and the construction company</p>	<p>Ask the promoter to act as a mediator</p>	
Auditorium	<p>Correction of some tasks</p>	<p>Greater care was taken in updating the documents</p>	Yes
Road bridge's extension	<p>The deputation became nervous and stopped the works</p>	<p>Increasing the presence of the project management in the bridge</p>	Yes
Single family home	<p>Tension between the promoter and the direction of the project</p> <p>Some extra costs due to changes made</p>	<p>Increase meetings</p>	Yes
Container port	<p>Complaints by the customer</p> <p>Non-payment at the delivery of the project</p>	<p>Increase meetings</p> <p>Travels to China</p> <p>Ask for written reports on the changes</p>	No

Luxury urbanisation	Strong overcharges in some of the urbanisation villas	Greater care in the management of documentation Make minutes of meetings	Yes
111 Households	Loss of the follow-up of some tasks of the construction	Regulation of the meetings	Yes
Single family home	Some extra costs due to changes made	Increase meetings	Yes
Road conservation	-	-	-
Canine recreational centre	Ignore project management in decision making Decrease in project quality	Increase meetings Ask the promoter for greater project management support	No
Residential building	Some extra costs due to changes made	Increase meetings	Yes

In order to solve the problem with the Colombian consultant in the project of Cartagena de Indias. The Spanish management did not have to do anything other than what it was doing previously; they simply had to intensify communications with Colombia, increasing the number of meetings and at the end, their proposals were accepted for the simple fact of being good solutions.

Things did not go well in the museum project. The project management team tried to continue the meetings between the parties involved in the project but came a time when the construction company refused to sign the minutes of the meetings. The communication was cut completely between the construction management and the construction company. The construction continued in this way until the end. This situation reached such an extreme because the coordinator of the work belonging to the promoter allowed it, leaving the management defenceless against the construction company.

In the extension of the bridge's project, in the end, things went well. The project management team reached an agreement with the town council, according to that the management would increase their presence in the bridge during the most delicate tasks, such as the case of closure. This action appeased the protests of the local citizenship when they carried out the works in the established term, fast and effectively.

In the projects related to the construction of houses for individuals, where the main problem is the client's willingness to make changes once the construction work is being carried out. Interviewees show the same solution, seen from two approaches. In summary, it can be said that the solution is to carry out more meetings with the client in the office of the project manager to reach an agreement in order to make possible modifications within a reasonable time. Something that can be done during the weeks to come and not immediately. This can be done in two ways. The project manager is always going to have to discuss with the client, the difference is that the construction company is present in these meetings or not. In the traditional triangle communication system explained above, the construction company would have to be present at the meetings to give their point of view and deal with the customer's requests. In the linear communication system, the builder has a schedule of the tasks that project manager knows so the construction company does not have to deal with this problem. The project manager should make the client aware that he cannot make any change in a period of time in which the builder is comfortable. In the case of the interviewee, the builder planned the works for the next 6 weeks, so any modification that transmits the project manager will not be made before 6 weeks.

Let us now turn to the container port project and the problems of communication with the Chinese client. As has been glimpsed in the approach to the problem, this problem has a difficult solution. At the time of non-payment by the customer, the communications were

completely cut off. Before arriving at this situation, the communications were completely normal, with the characteristic altercations and some misunderstandings because of the language. When the final report was presented, the Chinese client showed in the meeting a strange attitude. Showing his disagreement with some issues, the Spanish company wanted to know written those things that they had to modify to present the report again with the corresponding corrections, but after many calls and emails the Chinese client disappeared and the legal proceedings for claims for non-payment began. A sad end to an international project of great importance.

Regarding the project in Ibiza, the lack of communication between the commercial management of the company and the construction management was solved formalising this communication. Until the moment of the first complaints by the client had not identified any problem in the construction of the previous villas. Therefore, these meetings with the client, which continued to be informal, took place formally and in many of them, a representative of the construction management was present at the meetings. There was also a minute of the meeting, which was not done so far. Since the introduction of these changes, the construction management was aware of any possible changes from the outset and the rest of villas were executed without major problems.

Table 9 shows a series of solutions to the most widespread problems in the sector, set out at the end of the previous section.

Table 9. Solutions

Source: Own

Solutions		
Documentation management	Informality	Strong budget cuts
<p>BIM technologies</p> <p>Greater care and respect for the conventions of the document transfer system</p>	<p>Formalise communication structure until the workforce</p> <p>More care in the realisation of the minutes</p>	<p>Limit the budget reduction</p> <p>Promoter defend the project manager</p>

The use of new technologies can help in the management of documentation. As mentioned above using BIM-type technologies, the management of documentation in a company is much more effective. The updating of all documents is automatic and those involved in the project receive these updates automatically reducing the problem related to working with outdated documents.

According to informal communications, the solution is more complicated. This type of communication are very ingrained in the construction sector and trying to formalise them is very complicated. Normally the communication structure is much formalised from the work management upwards, with meetings in which the work-site supervisor, the project manager and even some other external agent or representatives of the promoter participate, in these meetings, a minute is written and everything is registered. The main problem is the informal communication that is done by the supervisor downwards, the workforce. This communication is not registered anywhere and therefore misunderstandings increase. It is common to say that the project manager is thinking monthly, the work-site supervisor weekly and the workers in the day. This difference of priorities can generate many problems and we must try as much as possible to involve all possible participants in the coordination meetings. From the top of the hierarchy of the company to the lowest, trying to raise awareness of the objective of the project and make them part of the decision-making in the programming of the construction works.

Regarding the problem of the excessive price decrease by the construction companies to win the bidding competitions and subsequently introduce an innumerable number of changes in the project to cover expenses and get the most benefit possible, some of the interviewees have very clear the solution. The main proposal is to limit these reductions in the budget and to adapt more to the bidding budget. In this way, no changes will be introduced and the builder will comply with what is established in the project. In case the construction company wants to be continuously introducing changes, the solution they propose is for the developer to fully defend the project management team. The management feeling supported by the project promoter has the power to force the construction company to fulfil the qualities stated in the project.

3.2.7. Overall communication assessment

To conclude the interviews, a final question was asked to try to generalise the general communication of the construction project. For this reason, the last section of this chapter will explain how the interviewees saw this communication. In Table 10 can be seen the overall communication assessment made by the interviewees.

Table 10. Overall communication assessment

Source: Own

Project	Overall communication assessment
Forts' protection measures	Depending on the phase, with the supervisor company was more aggressive, but in the end was enriching and effective.
Museum's rehabilitation	A total disaster. In the end, the relationship between the project management team and the head of the work was sinister, aggressive and derived in things out of place. Continuous conflict.
Auditorium	In general, it was all friendly, except for punctual things.
Road bridge's extension	Overall, everything was effective and friendly. Right.
Single family home	In general, in all my years of experience I would rate the communication as a kind relationship.
Container port	The communication throughout the project was good, all normal. Until the moment of delivery arrived that communications were cut at once.

Luxury urbanisation	It could be said that communication between project management and construction management has been good and effective. However, communication between business management and construction management has been a disaster.
111 Households	Very good
Single family home	Good
Road conservation	Communication is being very effective and friendly without any problems
Canine recreational centre	It depends, sometimes is really good but I have had bad experiences with the construction companies
Residential building	Usually, communication is good I have not had any problem

Figure 14 will summarise these assessments. The first thing that one can realise about Figure 14 is that the number of evaluations does not match with the number of projects analysed. The explanation is simple; as can be seen in Table 10 there are projects where the communication has varied according to the parts involved. Therefore, in the same project, among some participants the communication could have been very good and among other participants very bad. Another reason is that communication has evolved over time starting well and ending badly or vice versa. The last reason is that the interviewees have wanted to give several assessments, especially in the negative cases.

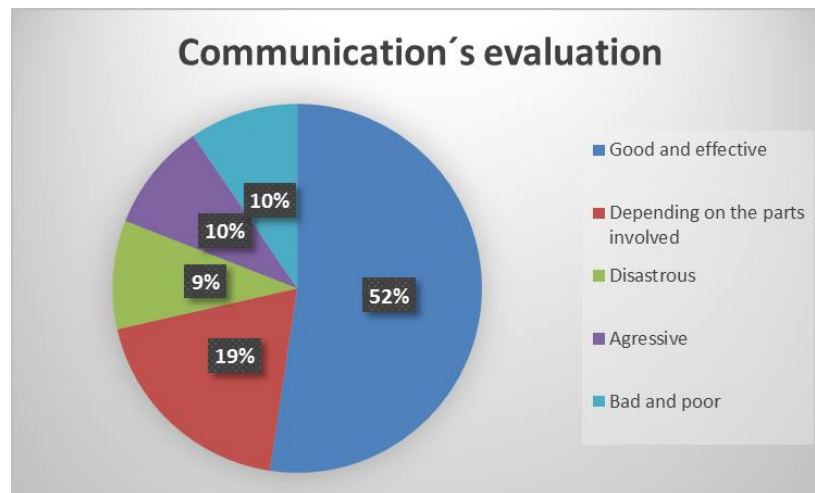


Figure 14. Overall communication assessment

Source: own

In summary, understanding that the 19% (depending on the parts involved) can be divided in a 10% for good communication and a 9% for bad communication. What can be said by observing this figure is that in the end, effective communication is present in the 62% of the projects while negative ratings of communication add up to 38% of the projects. This means that although the majority assessment is a good communication, in almost half of the projects in some moment or throughout the whole project, there has been a very bad communication. Something quite serious and far from desirable and therefore must be corrected. The need to improve communication in construction reinforces the purpose of this thesis. Analyse communication in construction projects. There is a long way ahead to solve all the problems that are generated in the construction and that as it is shown affects or is affected by the communication between the actors involved in the construction projects.

4. DISCUSSION AND CONCLUSIONS

In this final chapter, the results of the research are discussed. The chapter presents the main findings of the research and gives answers to the research questions presented in the opening chapter of the study. In addition, a comparison between the literature review and the empirical study is made. Finally, the managerial implications closes this thesis.

4.1. Findings per research questions

Recall that the main objective of the thesis was to analyse communication problems in construction projects. To this end, different specific objectives were established, which can be summarised in three questions. In this section, will be answered these questions briefly and concisely. Punctuating on the most relevant aspects.

- How does communication within a construction project work?

Knowing how fundamental feature works, such as communication, is very important for the correct development of the project. Still, the answer to this question is that it depends. Construction projects are unique and very difficult to carry out. Communication within a construction project is intrinsic to the project structure. Depending on the parties involved in the project, the type of procurement practice, the structure of communication and the communication networks that will be generated will be in one form or another.

The key is to have a good communication system, to favour communication being supported by good practices and to make clear from the outset the communication structure, with the organisation involved in the project and between the organisations that must collaborate to carry it out. In addition to establishing a way of proceeding, a hierarchy and a solid network of communication, it is very important to do everything that is available to those involved in the project to promote communication. Set aside individual objectives to favour the success of the project.

- Which are the main communication challenges/problems in the construction project?

The problems of communication and the reason they arise are presented in Table 7. In summary, it can be said that problems arise for three different reasons.

The first reason is related to the management of documentation. Not having a good management system or not respecting the conventions established in such documentation management system, derives in various problems. The most relevant problem is to work with documents that are not updated and the subsequent loss of time and money that involves correcting errors made on site.

The following communication problems are derived from the informality of many communications that should not be. In literature research, the importance of informal communication has been explained, but everything has a limit. The barrier between problems to be dealt with in a formal way and those that can be dealt with informally must be known. Knowing this barrier and therefore, to carry out correctly and formally the meetings and the practices that are necessary is very important to avoid many errors in the development of the project.

Finally, the major communication problems that have been observed are derived from a base error in the project, which is the excessive reduction of the bid price of the project. This reduction in the bid price means that the main contractor of the project wants to introduce many changes in order to save costs, with the consequence that the project management team opposes it. From this moment, the entire construction project becomes a permanent dispute between the project management team and the construction company. This situation, due to the experience of the interviewees, does not usually end amicably and should be avoided.

- What are the identified good communication methods/tools to tackle those problems?

The solutions to the communication problems explained above are set out in Table 9. Like the problems, solutions are collected in three distinct groups.

To solve the problems related to the documentation management, the most important thing is to have a good management system. It should be clear from the outset, which tool will be the main tool to be used in the project to communicate and all stakeholders involved should use it and respect the rules of use imposed by the managers. The use of new communication technologies such as BIM technology greatly facilitates this document management and should be gradually introduced in the construction sector.

The next block of solutions tries to solve the problems of informality in communication. It is crucial to have a solid formal communication structure and practices to avoid problems. All issues of vital importance to the project should be discussed within this formal communication network and should be recorded to avoid major issues being put on the air. For this, it is important to have within this formal communication structure the opinion of each member involved in the project and not leave aside the workforce as it usually happens.

The solution to communication problems stemming from budget cuts may be the simplest theoretically but the most difficult to carry out. The solution is as simple as limiting such cuts in the bidding budget, but today, it is still possible to make very strong decreases. If this cannot be avoided, the next thing is that the promoter of the construction defends the project management. In this way, it is avoided that the constructor makes changes at pleasure and therefore the quality of the project diminishes.

4.2. Literature review vs Empirical study

The literature review has begun emphasising the importance of effective communication in construction projects. It has been shown that in order to achieve good communication in a construction project, it is very important to have the networks and communication structures within the project clear, as well as the individual behaviour of the actors involved in the project. The empirical analysis has corroborated these claims. Making clear how important is to have a good communication system and the problems that can arise if these tools and practices are not clear or not all the actors push in the same direction.

Concerning communication problems. The literature review has emphasised the difficulty in communication due to the nature of the project and the barriers that exist within the organisations working on the project as well as between the organisations that work together. All the barriers exposed in these sections have also been corroborated by the empirical study. As can be seen in the tables corresponding to the problems generated by internal management and between different parts involved.

Regarding communication tools and practices. It can be observed that the tools shown in Table 2 of the literature research do not differ at all from those shown in the empirical study. It could be emphasised only that the e-mail that is considered a tool between formality and

informality in literature review; in the projects studied, actors have always considered it a formal tool.

Finally, must be reviewed the solutions provided by the literature review and those adopted in the construction projects studied. In this section, the literature review and the empirical study do not differ much either. In the literature review, it has been mentioned several practices that have also been applied in the various construction projects. The importance of understanding the communication structure of the project is basic in order to all actors understand their position and what they should do. Promoting upward communication is one of the concrete solutions adopted in one of the projects to improve the development of it. The use of new communication technologies has also been adopted in some projects. In those projects where ICT has not been applied, it has been tried with more traditional practices to maintain a good system of communication. Lastly, to create the best possible work team, even if not named explicitly always it is tried to do. The only practices that have not been adopted in any project and have been explained in literature research have been first, to favour the process integration. In the projects studied, it has been seen that the actors involved have been quite separate in terms of design and construction concretely. The second practice that has not been used has been to measure the effectiveness of communication and finally to integrate with the local culture since it has not been necessary for the characteristics of the projects studied.

Until here the comparison between the literature research and the empirical study ends, the conclusion is that the study is quite satisfactory since no relevant contradictions have been found that affect the veracity of it.

4.3. Managerial implications

The results of the study confirm the importance of communication within a construction project. How communication can be the key to success or failure of an entire project. It has been observed that the actors involved in these projects are aware of their importance, but do not always do everything possible to favour effective communication.

The good point of the analysis is that it has been observed that in terms of document management and the formalisation of communication, everything is fairly regulated and care is taken in the practices that are carried out. Although mistakes are made since construction

projects have an intrinsic complexity. There are many tools that are being used today, to a greater or lesser extent and with greater or lesser success, to solve such failures. It is positive that the use of these practices is increasing and the technology that accompanies it continues advancing to try to improve this communication management in the future.

The serious problem is found in some actors and business policies. A common denominator is self-profit. When you leave the common interests of the project aside, to prioritise your own interests, all problems begin to emerge. There is no tool capable of solving this problem, so it is necessary a change of mentality on the part of the parties involved in the project on some occasions. Prioritising the project to succeed and avoiding prejudice to the project, instead of prioritising the benefits themselves, should be a maxim in each construction project. It is in this aspect that emphasis should be placed from the beginning of the project and be sure that all the actors involved in the project are going to push together in the same direction.

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